South West Water

Our draft
Water Resources
Management Plan

Appendix 9: Lessons from the 2022 Drought

Contents

1 Introduction

Our draft Water Resource Management Plan (dWRMP) must understand and manage supply and demand changes over the long term. This includes changes to population, changes in the way our customers use water, changing needs of the environment and the challenges of climate change.

Until 2022, our approach to resource planning delivered 26 years without restrictions on use, such as temporary use bans, and had met the challenges of increased COVID-19 demands and demand spikes produced by extreme heat and extreme cold, such as the 2018 'Beast from the East' event.

The drought of 2022/23 was significantly different to previous experiences. While the South West has now moved from "drought" to "recovery" declaration by the Environment Agency, it is vital to review how the drought evolved and the impact that it had on our customers, communities and businesses so that the insight can inform our dWRMP planning.

2022/23 was different, both because of climatic factors, particularly the combination of heat and absence of rainfall and because of the continued increased demand which resulted from the societal legacy impacts of the COVID-19 pandemic. These factors were particularly acute in Cornwall and, later, Devon.

This appendix provides a review of the supply-demand position during 2022 to contextualise our dWRMP submission. It assesses our performance against the Defra-approved WRMP19 Planning Guidelines and the Drought Plan approved by Defra in 2022. It also provides an assessment of our performance against the revised assumptions established for our revised dWRMP supply baseline.

Our 2019 WRMP, as well as our 2020/25 Business Plan, were developed using historical information and forecasts based on assumptions and estimates informed by many different sources. Neither of these planning processes could possibly have foreseen the unprecedented impact the pandemic had on the UK, but more strikingly the unique impact seen in the South West in the first two years of this regulatory period. The societal changes produced by COVID-19 continue to impact us today.

For our dWRMP24, we are working towards resilience to a 1 in 500-year drought event from 2025. Our modelling at WRMP19 suggested that some parts of our network were already resilient to this standard based on our understanding of supply and demand at that time. We have updated our assessments with our latest assumptions for dWRMP24.

However, the 2022/23 drought was exceptional. For the first time in 26 years, we needed to implement Temporary Use Bans (TUBs) in the Colliford and Roadford Water Resource Zones (WRZs). We also had to apply for and secure a number of drought permits to allow the abstraction of additional water from our rivers and groundwater sources. During the drought we followed our Defra approved Drought Plan to mitigate the impacts of low rainfall and the extreme heat.

1.1 Background to our supply and demand system

The following information is provided to contextualise the analysis of the impacts of the 2022/23 drought on our supply region.

- 90% of the water we supply comes from surface sources – rivers and reservoirs. Our Devon and Cornwall network is supported by a strategic reservoir in each of our three WRZs. Bournemouth does not have a strategic reservoir, with most of our abstraction coming from the Hampshire Stour and Avon rivers.
- Our Colliford and Roadford WRZs are within the South-West peninsula and, as such, are isolated from potential interconnections to surrounding WRZs – there are no WRZs to the South or North. Similarly, our Isles of Scilly WRZ consists of islands which are geographically separated from each other and from the mainland. The Isles of Scilly form a single, stand-alone WRZ which cannot be easily supported by intra-company transfers and are currently dependent on the rainfall they receive.

- The large majority of our reservoirs hold water both for public water supply and to maintain 'compensation' water to supplement the flows downstream, either through continuous discharge or through 'fish bank release' to create artificial spates in the rivers. We cannot 'drain' our reservoirs and use all water for customer supply as we must maintain water to support compensation flows and ensure the health of aquatic life in the reservoirs themselves.
- 20% of overnight holiday stays in the UK are booked in the South-West, compared to 15% in London and 13% in the South-East (The Great Britain Tourism Survey (GBTS) 2021[1]). This is an increase in share from 18% in 2019[2]. The 9 months of (non-lockdown) data for 2021 estimates 65.8m nights' stay in the region compared to 66.9m nights for the whole of 2019. This is equivalent to a 12% increase in the non-resident population in the region each day. As such, the demand for water in our region is more variable than in other parts of the UK due to fluctuations in tourism numbers.
- The South-West also has the greatest proportion of second home ownership in the UK: 27%[3], compared to 12% in London and 14% in the South-East (English Housing Survey 2018/2019). These properties create different demand patterns as people move temporarily into the region. The greater opportunities to work from home that have resulted from the COVID-19 pandemic are changing the way people use second homes. The impact on demand of changing second home use is more acutely felt within our region than elsewhere in the UK.

2 Overview of the 2022 drought

2.1 Weather and River Flows

The UK experienced a challenging water resource situation over the course of 2022, with a period of below average rainfall that began in November 2021.

As the following section sets out, our water supply has been materially impacted by the weather we experienced during 2022. Exceptional Shortage of Rainfall (ESOR) has been compounded by extreme temperatures leading to marked reductions in effective precipitation across our region.

The following section sets out key statistics based on UK and our own local supply region data.

From a review of UK wide statistics on rainfall and temperature we can conclude:

- The 8-month period from November 2021 to June 2022 was the driest in England since 1975/76, with an average of 421mm of rain falling in England, 74% of the 1991/2020 long-term average of 568 mm[4].
- July 2022 was the driest July for England since 1935[5].
- Two exceptional hot spells across July and August 2022 led to unprecedented water demand and wildfire risk, exacerbated by high evapotranspiration rates and soil moisture deficits. Overall, summer 2022 (June, July, August) was the joint hottest summer on record for England[6].
- Up to and including November 2022, England saw 15 consecutive months with a mean temperature above the 1991/2020 average[7]. These temperatures also helped to shape a unique water supply/demand situation.

[1] GB Domestic Overnight Tourism: Latest results | VisitBritain

[2] Great British Tourist Report 2019 (gov.wales)

[3] 2020_EHS_second_homes_factsheet.pdf (publishing.service.gov.uk)

[4] July 2022: a dry run for UK's future climate? | Official blog of the Met Office news team

[5] Driest July in England since 1935 - Met Office

[6] Joint hottest summer on record for England - Met Office

[7] UK temperature, rainfall and sunshine anomaly graphs - Met Office

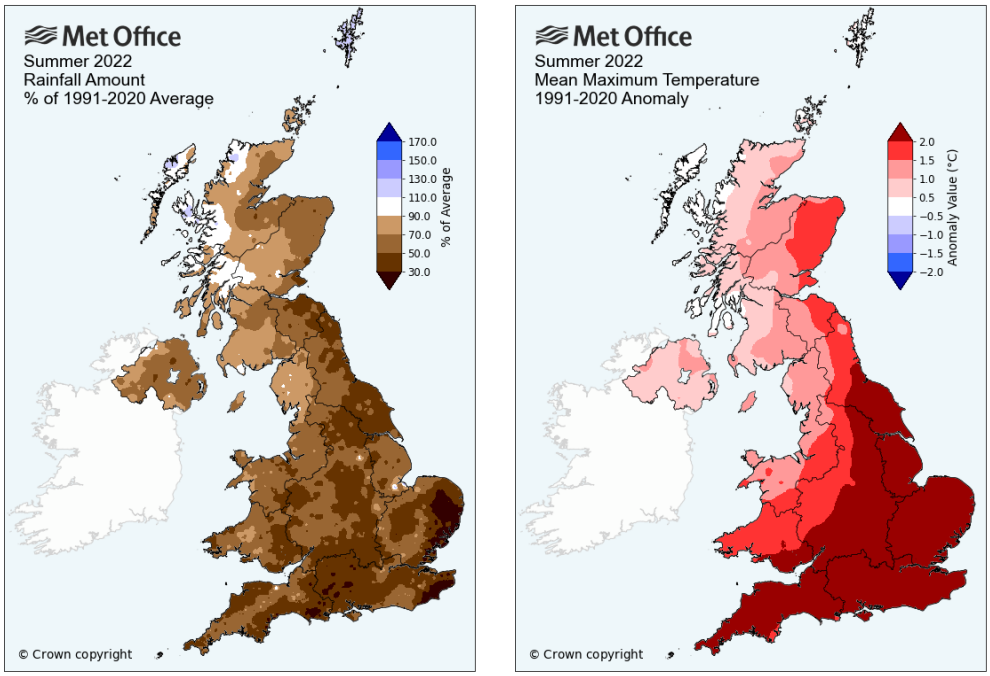

Figure 1: Met Office maps showing anomalies in rainfall and mean temperature for summer 2022.

If we consider the experience in our supply area in more detail, the Met office has set out that:

- we saw an Exceptional Shortage of Rainfall (ESOR) in 2022
- across the region, we have seen rainfall, over an extended period, at the 2nd or 3rd lowest level since the 1890s
- we also had extreme heat with the warmest year on record, which impacted both evaporative losses from our reservoirs and increased demand for water as customers maintained their gardens, filled paddling pools, and kept cool
- effective precipitation (rainfall figures adjusted for evaporative loses) meant our Roadford and Wimbleball Zones saw drier conditions than in all 60 reference years of the Met Office's MORECS records.
- lower rainfall also increased the requirement for supply releases from our reservoirs to maintain drought-depleted river flows.

These weather variables and their impact on our supply-demand position are considered in our long-term planning, particularly when we consider climate change and future resilience to 1 in 500-year droughts. While 2022 was not, on a rainfall measure alone, a 1 in 500-year event, the combination of supply/ demand pressures resulted in a situation in our Colliford WRZ beyond the current WRMP19 1 in 200-year design condition.

2.1.1 Temperature

In terms of temperature anomalies, the event ranked first for both the 9 and 12-month averages and 2nd or 3rd for the 6-month average, depending on the specific WRZ. This is based on the records dating back to 1884, indicating that the heat return period was exceptional, especially when combined with the dry weather.

High temperatures also increase direct evaporation from our reservoirs, up by ~0.5% during 2022.

2.1.2 Rainfall

We worked with the Met Office to analyse rainfall patterns across our region. The 12-month deficit at the end of October 2022 ranked as the 6th driest for Colliford, 3rd driest for Roadford, 2nd driest for Wimbleball, 7th driest for Bournemouth, and 11th driest for St Mary's since 1891.

The associated rainfall return periods suggest the event was as extreme as a 1 in 20-year event in Colliford and Bournemouth, and as/ more extreme than a 1 in 30 year event in Roadford and Wimbleball.

We have analysed rainfall to calculate a Standardised Precipitation Index (SPI) which allows a comparison of the severity in the rainfall accumulations between years and locations. These are shown on charts below for Colliford and Roadford WRZs and highlight that for particularly periods in 2021 to 2022 the severity of the rainfall. In Colliford WRZ only 4 years are classified as "Extremely Dry" in 130 years of record of which 2022 was the joint third driest for a period between November and August. In Roadford WRZ, the intensity of the drought was focussed over a shorter duration, and the March to August period was classed as the 3rd lowest SPI

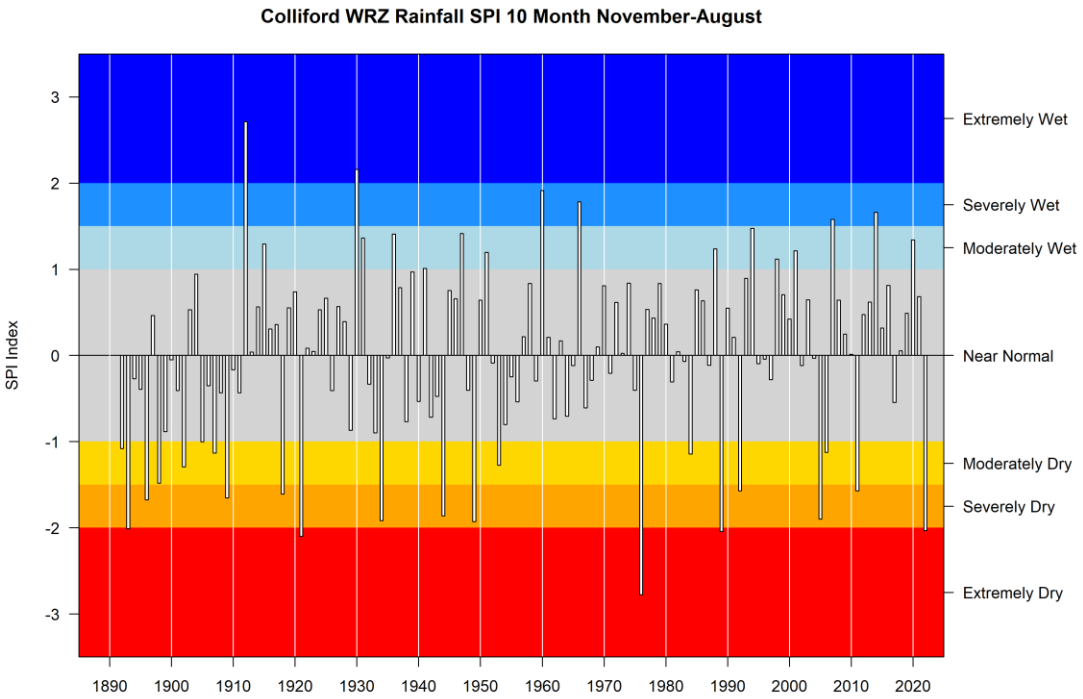

Figure 2: Colliford WRZ 10 month (November to August) SPI for full period of record.

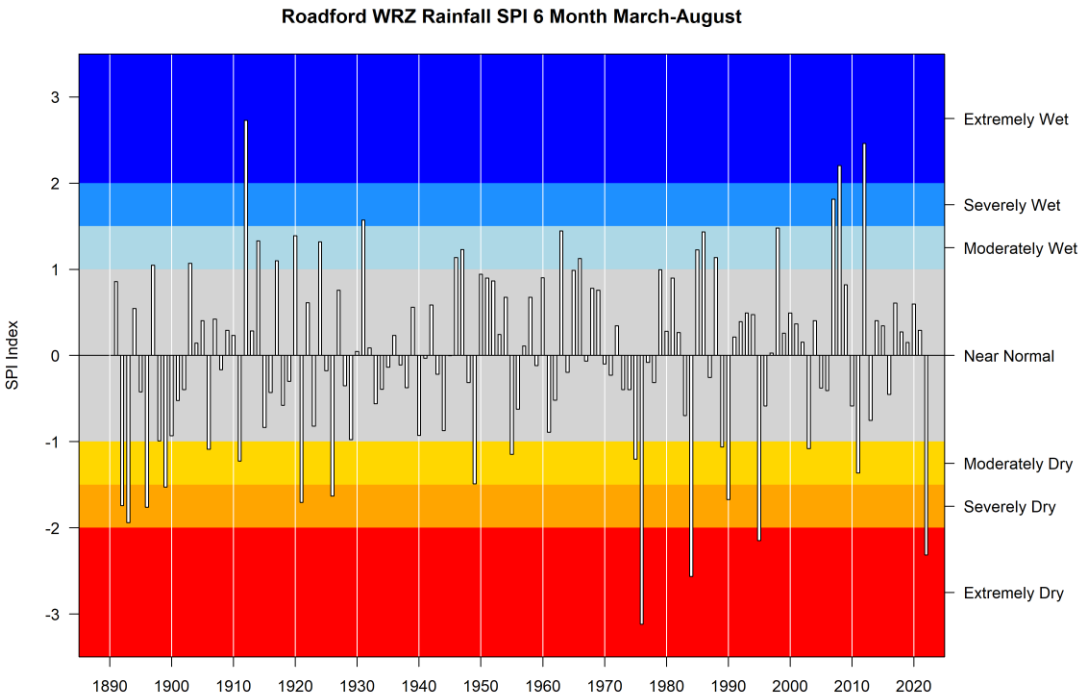

Figure 3: Roadford WRZ 6 month (March to August) SPI for full period of record.

2.1.3 Effective Rainfall and Soil Moisture Deficit

Effective Rainfall, also called Effective Precipitation (EP), is the amount of rainfall that is added to the soil. During drier periods, low rainfall events would not be considered 'effective' in adding moisture to the soil because low rainfall would likely evaporate from the surface before soaking into the ground. Effective rainfall enters the soil and from there is a source of flow into rivers and on into reservoirs. When there is no effective rainfall it means that the a soil moisture deficit (SMD) develops. This describes the amount of rainfall the soil can absorb because it is dry and means that this water would not typically runoff to rivers. At the end of a dry period this effect can be witnessed where river levels do not increase even though it is raining.

Met Office analysis of water balance variables derived from the MORECS dataset confirmed the contribution of temperature and in turn evaporation, to the drought conditions over the last 12 months. The excess evapotranspiration led to significant effective rainfall deficits (below 60% of the climatological baseline) and equally extreme soil moisture deficits.

The situation for the Roadford and Wimbleball WRZs were the most extreme in terms of these water balance variables. The event ranked as the 1st driest both for effective rainfall and for soil moisture deficit.

Including the effect of heat-driven evapotranspiration on rainfall in the analysis of the 2022 drought, leads to some clear differences to the standard ESOR analysis, which only considers rainfall in isolation and is used to support the application of drought permits.

The evolution of the deficit in MORECS EP is presented below for Colliford. The evolution is similar to that of rainfall but with negligible contributions to the accumulation between March and August when evapotranspiration largely exceeds any rainfall that does occur. This means that while some rainfall fell between March and August, this rainfall was not effective – it added little to water resources. At the end of October, EP was only 60% of long term average since November 2021. Furthermore, unlike the droughts of '76 and '89, there was no strong recovery of effective precipitation in September and October and it wasn't until November that recovery of this position occurred. The evolution of EP for Roadford shows a slightly more severe situation than Colliford, with accumulation remaining below 55% of the climatological baseline. This 12-month EP accumulation ranked as the driest ever recorded in the 1961-2022 period.

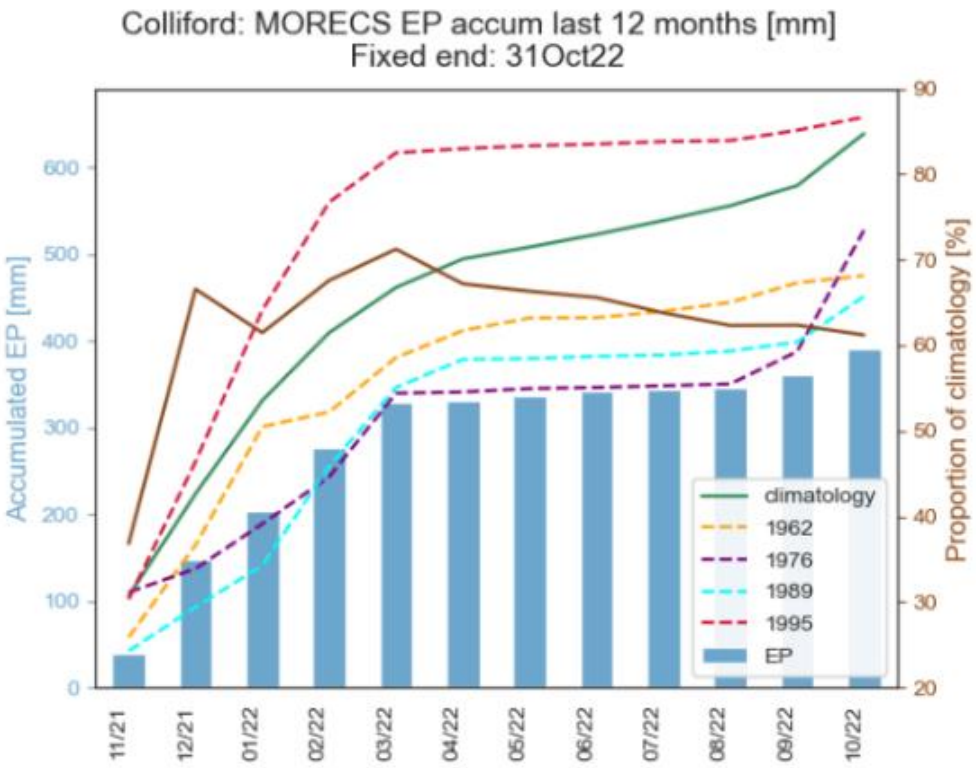

Figure 4: Evolution of the monthly EP accumulations over the previous 12 months (light blue bars) and the climatological baseline (green line) as reference. Dashed coloured lines indicate reference years. Brown line presents the accumulation as a percentage of the climatology.

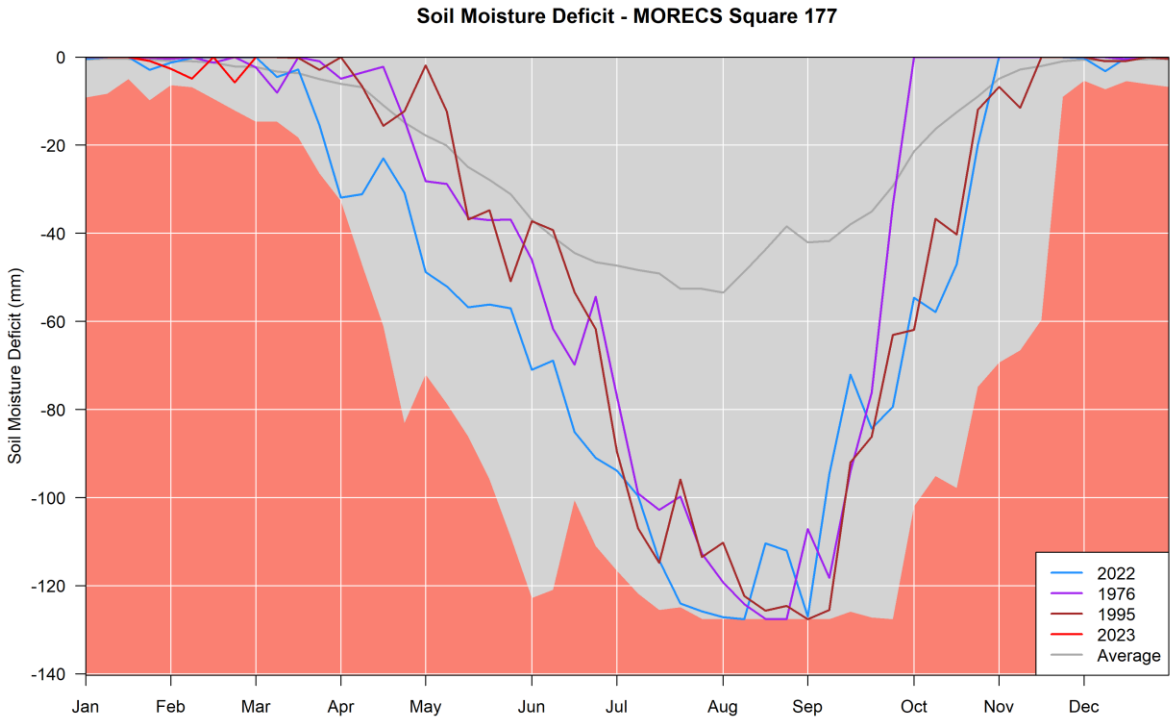

Figure 5: Soil Moisture Deficit (SMD) in Roadford WRZ. Comparison of 2022 (blue) with historical drought years.

The SMD for Roadford WRZ is shown in Figure 5 and it is similar pattern in our other WRZs in the region. The SMD began to accumulate from the beginning of March and did not recover until the start of November. This duration of continued deficit is longer than any previous historical event in the MORECs dataset (starting in 1961). The 2022 maximum deficit occurred in early August and September and was the highest on record for those periods of year.

2.1.4 Extreme Combined Temperature and Rainfall Effects

There are also some stark observations when considering the joint temperature and rainfall anomalies. The graph below shows the covariance of rainfall and temperature for the Colliford WRZ for the period between 1884-2022, the 2022 event ranks in the top two for both variables.

The October 2022 12-month average temperature conditions were the warmest on record, while the rainfall deficit matches or exceeds all the reference years, even 1975/1976, which saw a notably wet September and October period in 1976.

The analysis is set out over a 12-month period, the duration of the 2022 drought. Further graphs for the other zones can be found at Annex A: Analysis for other Water Resource Zones).

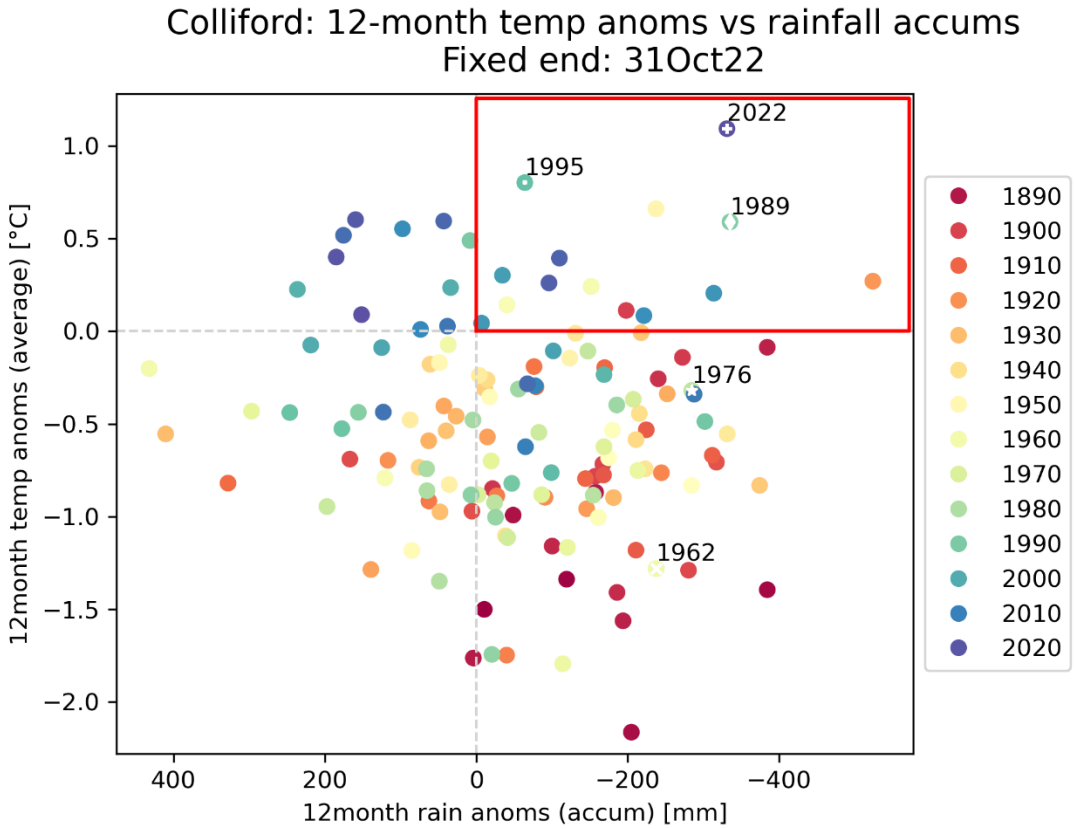

Figure 6: Graph showing temperature and rainfall anomalies by year.

2.1.5 River Flows

Given the impacts outlined in the previous section for temperature, rainfall and effective rainfall it is expected that river flows would have been severely impacted by the 2022 drought. For the period from April to September 2022 some of the rivers in our region experienced record low levels (Figure 7). The impacts were experienced widely affecting all the rivers in our region as highlighted by a snapshot of our weekly Water Situation Report from August 2022 (Figure 8).

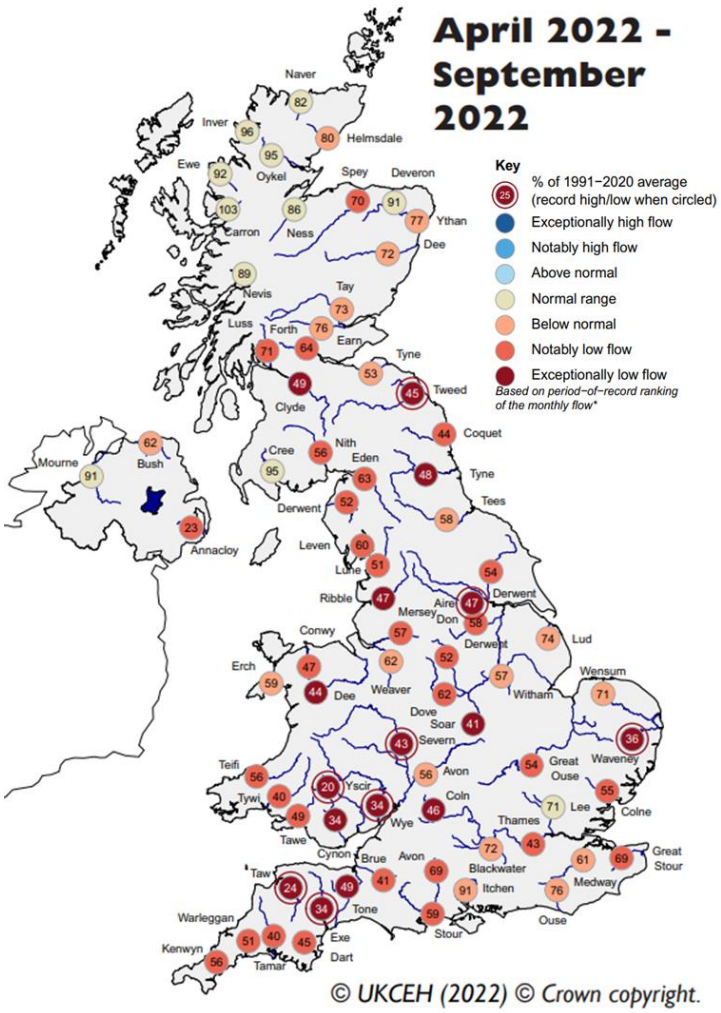

Figure 7: April to September average river flow as a percentage of long-term average.

River Flows on 29 August 2022

	Station details			Current flow	
	River	Location of gauging station	Catchment area (km^2)	Flow at 0600 (m^3/s)	As % of monthly average
1	River Fowey	Restormel	169.1	0.81	36%
2	River Hayle	St Erth	47.6	0.15	37%
3	River Kenwyn	Truro	19.1	0.04	30%
4	River Camel	Bodmin Dunmere	139	0.37	18%
5	River Gannel	Gwills	41.0	0.05	21%
6	River Erme	Ermington	43.5	0.28	23%
7	River Dart	Austins Bridge	247.6	1.17	22%
8	East Dart River	Bellever	21.5	0.14	20%
9	River Teign	Chudleigh Bridge	232.2	0.47	25%
10	River Tavy	Ludbrook	197.3	0.64	16%
11	River Tamar	Gunnislake	916.9	2.49	29%
12	River Torridge	Torrington	663.0	0.61	12%
13	River Taw	Umberleigh	826.2	0.71	12%
14	River Mole	Woodleigh	327.5	0.34	8%
15	River Exe	Thorverton	600.9	1.77	28%
16	River Otter	Dotton	202.5	0.88	51%
17	River Stour	Throop	1073	1.58	44%

Monthly averages are for 1991-2020 except for Bodmin Dunmere and Chudleigh Bridge

Figure 8: Example river flow table from our Water Situation Report for the end of August 2022.

The low rivers flows have two substantial impacts on our water resource position.

1. It reduces the amount of water we can abstract from our sources or that refills our reservoirs
2. Many of our abstractions from rivers need to be supported by our reservoirs when river flows are low which depletes the amount of water in our reservoirs. An example for the River Tamar at Gunnislake is shown in Figure 9. Roadford reservoir was required to support abstraction from May to mid-October and provide 100% of the abstracted volume from June to August. The releases are shown in a system context below.

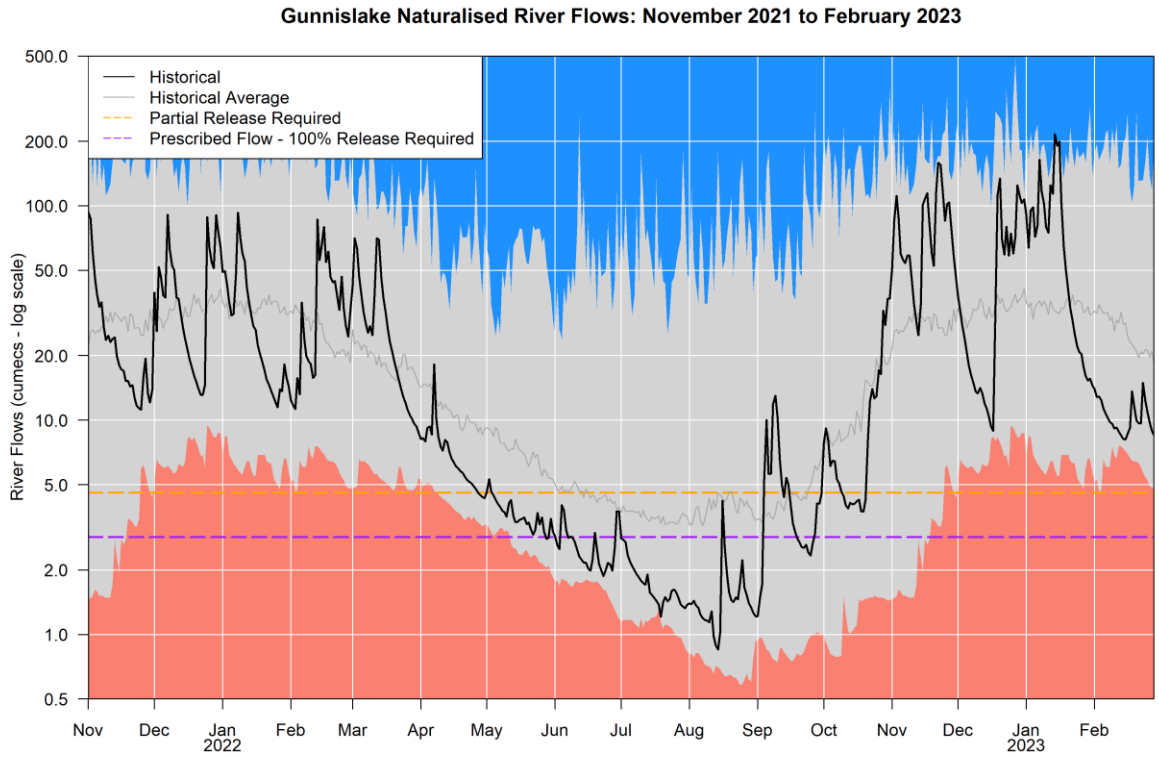

Figure 9 River flows for the River Tamar at Gunnislake during 2022. Supply releases from Roadford reservoir are required when river flows drop below the orange line.

2.2 Demand

2.2.1 Summary of Demand

In 2022 demand for water in our region was on average 8% higher than our WRMP19 forecasts.

As discussed in our Demand Forecasting Appendix (Appendix 2), since early 2020 our consumption has been impacted by the COVID-19 pandemic. There are still significant uncertainties around what a post Covid-19 pandemic consumption looks like for our region and the impact on our demand position has reduced but can still be seen in our consumption trends. Some of the lasting impacts have been a significant, short-term change to tourism and second home occupation and a long-term change in where people work in our region. Working from home and hybrid working continues to impact household and non-household consumption. Non-household consumption in 2022/23 was still not back to pre-pandemic levels despite the hot weather.

Although our demand was higher than forecast during 2022, we saw annual household consumption reduce. However, the implementation of usage restrictions in our Colliford and parts of Roadford WRZs and our region-wide water efficiency messaging would have suppressed demand making it difficult to definitively quantify the impacts of drought weather on consumption.

2022 saw some of the hottest, driest weather on record which produced significant changes in soil characteristics combined with increasing flows through pipework under additional stress leading to increased network losses. At the end of 2022 our region also experienced a significant freeze/ thaw event. This meant

a challenging year for leakage management and our 2022/23 in-year figure increased compared to 2021/22 although we maintained our 3 year rolling average performance to meet our performance commitment.

2.2.2 The impact of the 2022 weather on demand

Increased demand had a significant impact on the supply/demand balance in 2022. Demand increases combined with reduced effective precipitation were the main driver behind the requirement to implement the Drought Plan. 2022 was the 4th driest summer in 130 years. A hot, dry summer combined with high levels of soil moisture deficit and increased network activity put pressure on two of our strategic reservoirs, Colliford and Roadford.

The chart below shows that although the total rainfall in 2022/23 was very similar to 2021/22 it was the timing and effectiveness of rainfall that had a significant impact. The amount of rainfall between May and November 2022 was below both previous years, the cumulative totals did not converge until November.

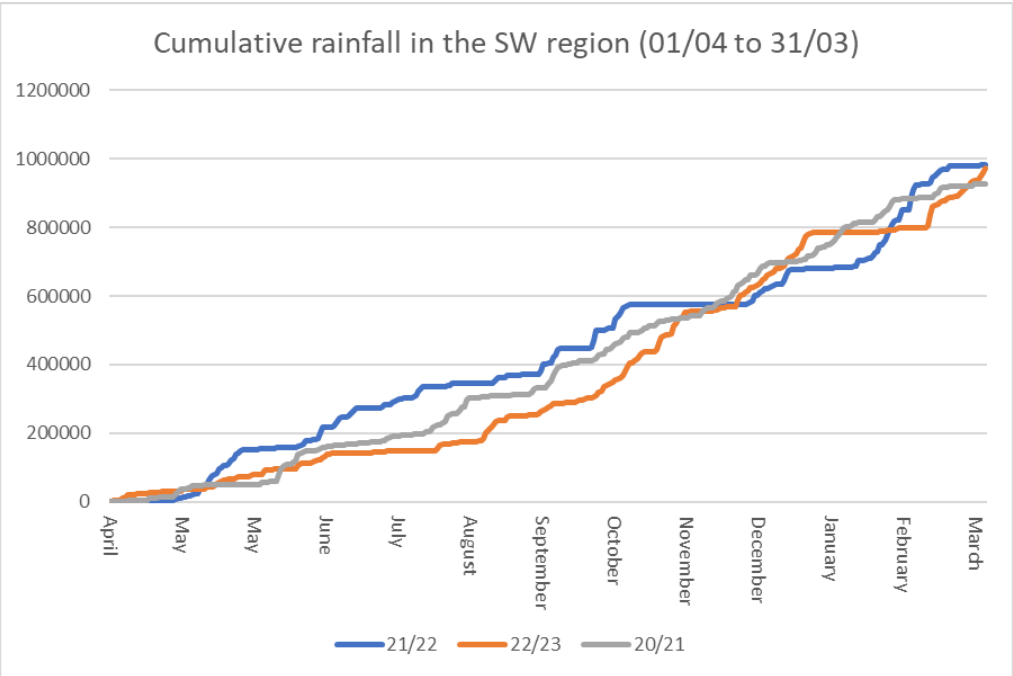

Figure 10 Cumulative rainfall

The lack of rain coincided with increasing temperature into the summer and the tourist period.

The impact of the lack of rainfall on demand and compensation releases is seen in Figure 11 below. The majority of the step up will be driven by the seasonal peak in tourism and other sectors such as agriculture but domestic consumption will also have been impacted by the dry weather, pushing demand up.

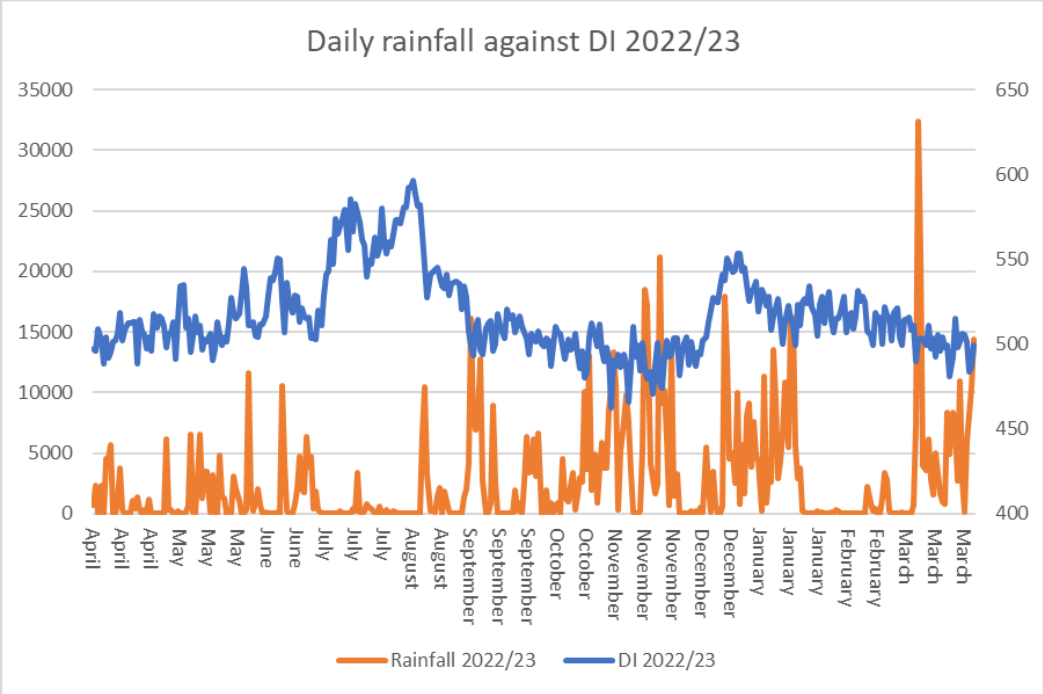

Figure 11: Daily rainfall against DI in 2022 and 2023

The reduction from August into the Winter will reflect the influence of rainfall, the end of the school holidays and TUBs on demand.

At the end of November/start of December a short but significant cold weather event caused an outbreak of network issues which resulted in an increase in demand, shown below.

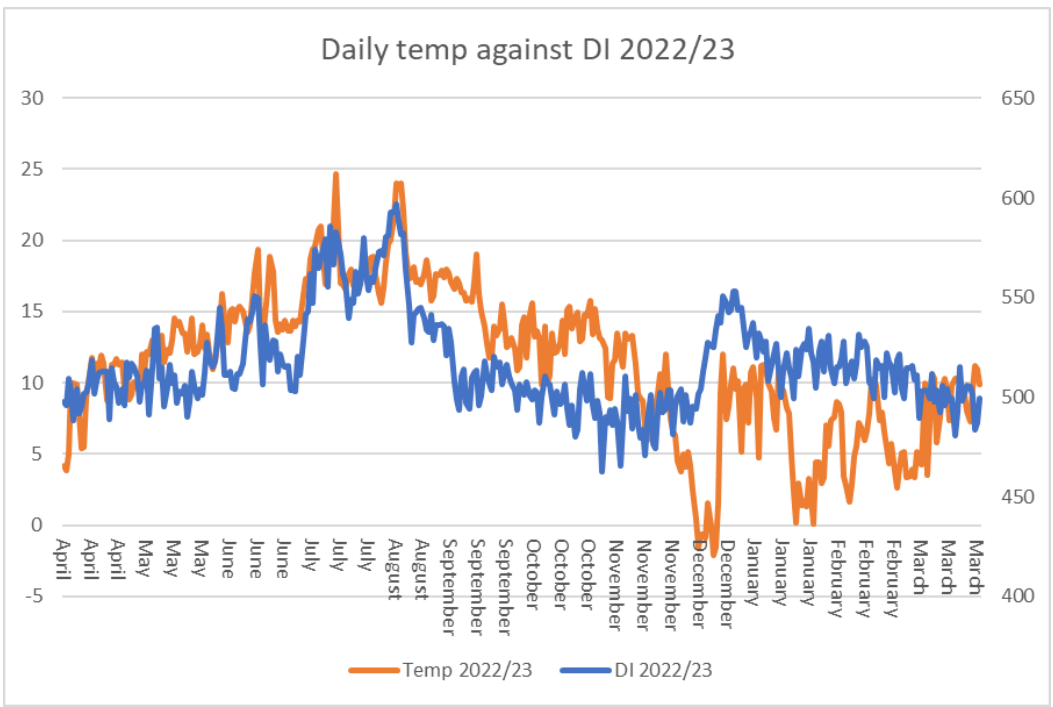

Figure 12 Daily rainfall vs DI

2.2.3 Comparing 2022 demand

Comparing consumption volumes in 22/23 to 21/22 there was a -5.4 Ml/d (or -1.5%) reduction in Household consumption and a +9.9 Ml/d (or +6.6%) increase in non-household consumption.

The Table below shows a summary of our actual 2022/23 demand metrics against our WMRP19 forecast.

	WRMP19 22/23	Actual 22/23	Difference Ml/d	Diff as %
Measured Non-household - Consumption	140.43	155.70	15.27	10.87%
Unmeasured Non-household - Consumption	2.86	3.09	0.23	8.04%
Measured Household - Consumption	213.39	232.37	18.97	8.89%
Unmeasured Household - Consumption	82.16	119.62	37.46	45.60%
			000's	Diff as %
Population	2256.45	2279.85	23.40	1.04%
Properties	1087.01	1088.52	1.51	0.14%

Table 1: Actual 2022/23 demand metrics against our WMRP19 forecast

Our recorded consumption for 2022/23 was greater than our WRMP19 forecast for every customer class. Measured consumption is a similar increase for Household and Non-household.

In comparison to our WMRP19 forecasts our properties and population numbers for 2022/23 show negligible difference.

PCC, calculated using resident population only, in 2022/23 was 157.5 l/p/d. This is a reduction in consumption compared to 161 l/p/d in 2021/22.

2.2.3.1 Household consumption

In 2022/23 household consumption showed very different outcomes between measured (reduced by -10.8 Ml/d (or -4.4%)) and unmeasured (increased by +9.5 Ml/d or +4.7%) households. The prolonged hot, dry summer will have influenced consumption, potentially offsetting some of the water efficiency activities implemented in 22/23 (which we are continuing in 23/24). The increase in unmeasured consumption could indicate that many of our remaining unmeasured customers are not switching to measured bills due to their water use behaviour.

In August 2022 TUBs restrictions were introduced in Colliford WRZ, alongside free water butts, before our successful "Stop the Drop" campaign to protect Colliford Reservoir in November and December 2022. As part of measuring the success of the "Stop the Drop" campaign the change in consumption through our IHM (Individual Household Monitor) meters showed a 4.6% reduction in weekly PHC (measured across the 6 weeks pre and post campaign) in Colliford, which is shown in Table 2 below.

Supply Zone	Pre Incentive Weekly PHC m^3	Post Avg. Weekly PHC m^3	Var.	%
Colliford	2.538	2.421	-0.117	-4.61%
Roadford	2.662	2.634	-0.028	-1.04%
Wimbleball	2.857	2.774	-0.083	-2.92%

Table 2: Pre and post incentive weekly PHC.

We are still reviewing the trends in consumption in 2022/23, but it is very positive in terms of our water efficiency activities that all of the South West WRZs, excluding Bournemouth, showed annual reductions in Household consumption, shown below.

WRZ	Change in Household consumption from 21/22 to 22/23
COLLIFORD	-3.47%
ROADFORD	-2.94%
WIMBLEBALL	-2.31%
BOURNEMOUTH	3.69%

Table 3: Change in household consumption 2021/22 to 2022/23

2.2.3.2 PCC

As detailed below, in response to the drought in summer 2022 we increased our water efficiency campaigns across the region in tandem with direct water efficiency engagements, through Household audits for example and in combination with hosepipe bans in Cornwall and a part of North Devon drove an overall Household consumption reduction in 2022/23. In 2022/23 our resident population was 0.7% higher than in 2021/22 which would be predicted to increase consumption slightly so comparing PCC values is a good indicator of our demand management activities in 2022.

	Average household PCC (l/p/d)		Difference	
	2021/22	2022/23	l/p/d	Diff as %
Colliford	162.8	156.6	-6.3	-3.8%
Roadford	156.1	150.5	-5.6	-3.6%
Wimbleball	154.5	148.3	-6.2	-4.0%
Bournemouth	172.6	178.6	6.0	3.5%
Regional	161.0	157.5	-3.5	-2.2%

Table 4: Average household PCC

Bournemouth is the only WRZ that showed an increase in PCC as shown above. Due to the resource situation in the SWW region in sum 2022 the water efficiency activities were less focussed on Bournemouth. We will be working to better understand this increase and to expand our water efficiency work to Bournemouth.

The Table 5 below shows a comparison of 2022/23 PCC to WRMP19 forecasts.

	Average household PCC (l/p/d)		Difference	
	WRMP19 Forecast	2022/23 Actual	l/p/d	Diff as %
Colliford	144.6	156.6	12.0	8.3%
Roadford	134.3	150.5	16.2	12.1%
Wimbleball	121.2	148.3	27.1	22.3%
Bournemouth	139.2	178.6	39.5	28.4%
Regional	135.6	157.5	21.9	16.1%

Table 5: Average household PCC 2022/23 vs WRMP19 forecasts

The most significant driver on the difference to forecast is the impact of the COVID-19 pandemic. Post-COVID water use behaviour is still re-balancing. Also, the hot, dry weather conditions in 2022 are likely to have driven increased external garden use and use of water to fill pools and hot tubs for example. Due to the uncertainty around the long-term impacts of COVID-19 and the usage restrictions in 2022 it is difficult to determine the proportions of what is driving the higher consumption.

2.2.3.3 Non-household consumption

In every WRZ, Non-household consumption increased in 2022/23 compared to 2021/22 and regionally increased by 8% as shown in Table 6 below.

	Non-household consumption (Ml/d)		Difference	
	2021/22	2022/23	Ml/d	Diff as %
Colliford	30.8	32.7	1.9	6.3%
Roadford	42.9	45.3	2.4	5.6%
Wimbleball	18.3	19.5	1.2	6.7%
Bournemouth	20.2	23.5	3.3	16.5%
Regional	112.1	121.0	8.9	7.9%

Table 6: Regional supply & demand position

However, this increase in Non-household consumption should be viewed in the context of the impact of COVID-19. Although it has been increasing since the lockdowns and restrictions of 2020/21, annual Non-household consumption is still not back to pre-COVID levels, see Figure 13 below.

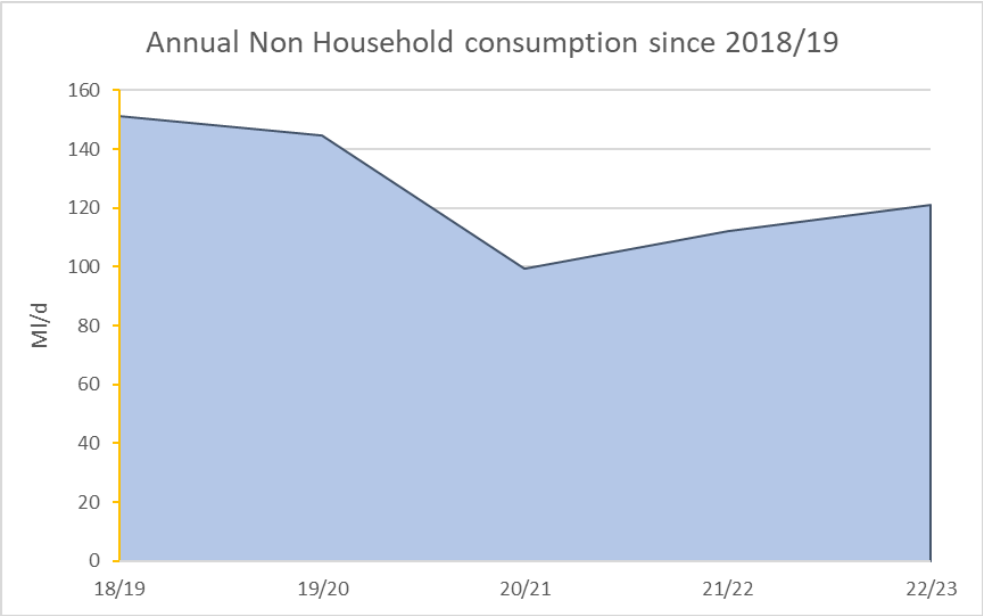

Figure 13 Annual NHH consumption

It is an interesting outcome that despite the drought our Non-Household consumption was still 16% below pre-COVID levels in 2022 and it remains to be seen when and if this type of demand will return to historic levels.

The hot, dry weather of summer 2022 will have affected certain Non-household sectors more. For the South West region, tourism and agriculture are significant sectors of commercial consumption and potentially influenced by weather. Our Non-household consumption monitor comprises data logging a small number of

large customers. For tourism related customers, the logged data in 2022/23 (Figure 14 below) shows the gradual recovery of this sector since the COVID-19 lockdowns. This is a small sample of our larger customers but clearly shows the impact of the lockdowns in 2020/21 and early in 2021/22 on tourism and how 2022/23 had a full year of tourist influence on demand. The impacts of having a 'normal' year for the school holidays can be seen against the lockdown restrictions in previous years.

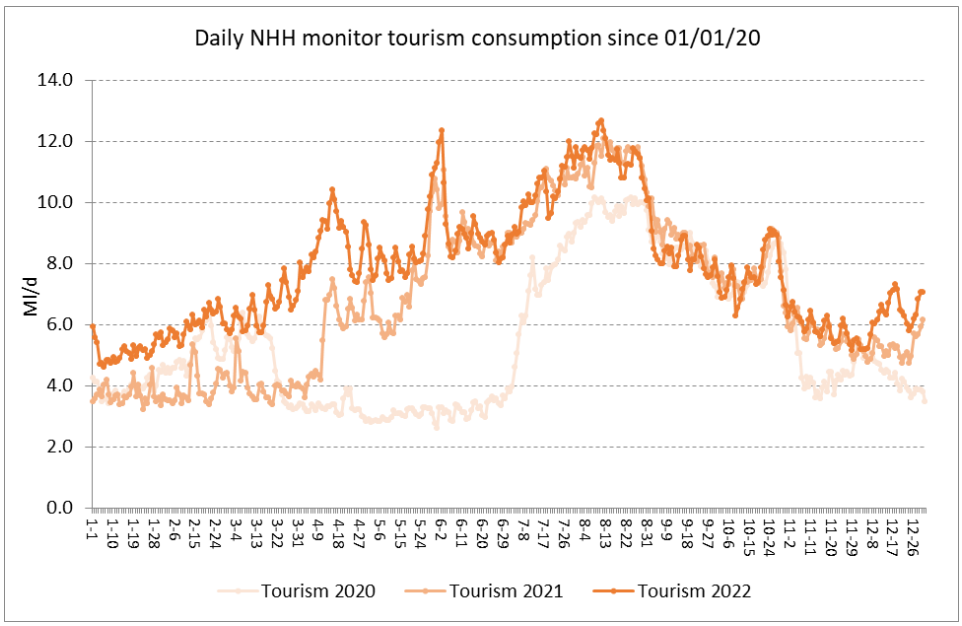

Figure 14 - Daily NHH tourism consumption

Agricultural consumption was less affected by lockdowns, but the consumption has steadily increased from 2020/21 to 2022/23 and in 2022 was above previous levels. The wetter summer of 2023 has seen a suppression of agricultural consumption, so this sector is likely to have been impacted by the drought and indicates the opportunity to work with our customers in this sector on water efficiency initiatives such as rainwater harvesting and re-use projects to ensure their resilience in the future.

Office-based consumption and education-based consumption both increased in 2022 but that is more likely to be people returning to work in offices and more higher education learning returning to face-to-face and on-site delivery.

The loggers deployed on our Non-household monitors were mainly deployed in 2019/20 for consistency reporting so it is not possible to compare to historical pre-COVID demand. We will continue to track these trends as we look to better understand the long-term impacts of COVID-19 and the drought on commercial customer consumption.

2.2.4 The impact of the drought on our water efficiency activities

In response to the drought situation in 2022/23 we increased our water efficiency activities across household and non-household customers. We implemented many new ways to promote water efficiency and engage with our customers.

The benefits from water efficiency for demand management on our long-term resource situation and engagement with our customers means that we are continuing many of these activities as long-term BAU water efficiency rather than short-term drought responses.

These benefits have been included in our WRMP24 planning as impacts on our demand forecast.

2.2.4.1 Household water efficiency

In 2022/23 we delivered the following household water efficiency activities, all of which we will be continuing throughout AMP7 and into the WRMP24 planning period.

Household audits.

In late summer of 2022, we began working with Cenergist, a specialist contractor for home water efficiency audits, delivering Household audits in the Colliford WRZ.

The way we conduct these audits is to notify customers in a particular area via letters then follow up with phone calls to book appointments. When in the area, Cenergist also do door knocking to contact previously unavailable customers.

The Household audit consists of engaging with customers to encourage behavioural change alongside device installation. With the customer's permission there is a check for internal leaks (on taps etc) and repair of minor leaks. Water savings devices are installed (if suitable), for example aerated shower heads, shower regulators, tap inserts, leaky loo strips. Cenergist are Waterwise accredited for the installation of retrofit products.

Our agreement with Cenergist covers 3 types of Household audit depending on which is the most appropriate for the customer. A retrofit audit covers education and water saving device installation. The *metersave* audits include installing, with the customer's permission, flow regulators at the customer meter. Additionally, customers in Colliford have been able to notify us through our website if they have a leaky loo and we send Cenergist to fix the issue for them.

The activity summary for 2022/23 is below and shows consumption reductions.

	Cost per audit	Number of Audits	Assumed Savings (l/p/d)	Assumed Savings (Ml/d)
Retrofit	£57.28	3027	49	0.15
Metersave 3P	£109.27	206	80	0.02
Metersave 2P	£99.43	1309	80	0.10
Ad Hoc Toilet Fix	£99.87	118	307	0.04
Total				0.31

Figure 15: Activity summary 2022/23

In 2022/23 these audits were focussed on Colliford WRZ. From 2023/24 we are expanding the remit to other WRZs where possible.

Free Water Saving Products

Through our partners *SaveWaterSaveMoney*, customers can request free water saving products by visiting *GetWaterFit*. It is not currently possible to link products to overall consumption reductions, but we believe this initiative is an important promotion for customers to pro-actively engage with water efficiency. This initiative continues in 2023/24 and below shows how customers can access this service.

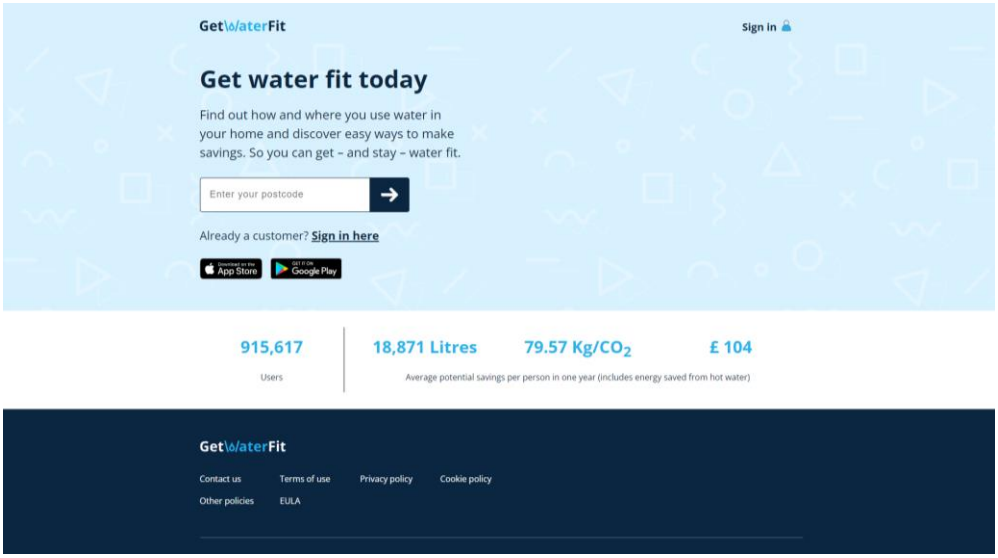

Figure 16: Get water fit screen shot.

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Water Butts

Since August 2022 SWW has been offering free water butts, of 100 litre and 200 litre sizes, to customers via our website. To obtain a free water butt, customers fill out a questionnaire and are eligible if they indicate they use potable water for garden watering as this initiative is very much focussed on reducing seasonal external water use. Households have been able to claim one free water butt.

The chart below shows the trend in supply of free water butts to customers.

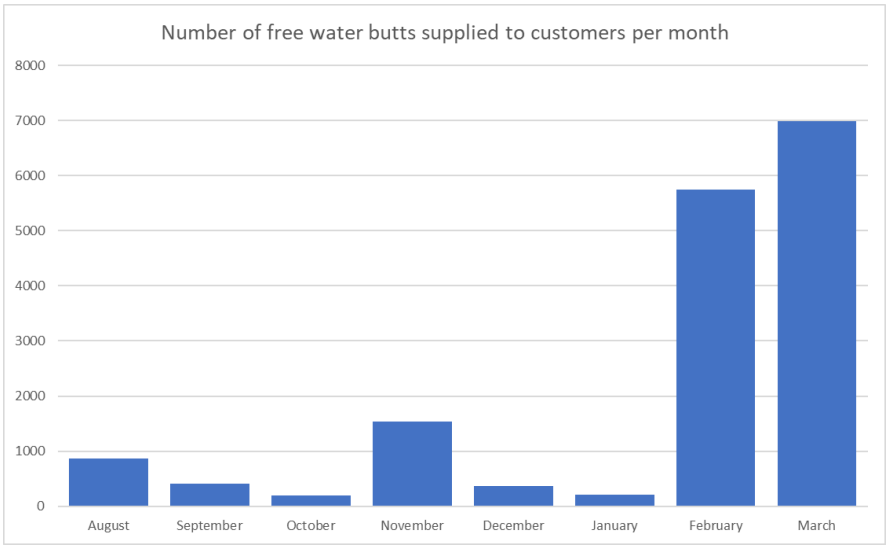

Figure 17: Free water butts issued.

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In 2022/23 the company supplied over 16,000 free water butts to customers. This initiative has continued in 2023/24 and we have now supplied over 60,000 free water butts to date.

We are currently evaluating the impact of providing water butts to our customers to inform our provision strategy.

Stop the drop

In November 2022, the company announced a customer incentive campaign to minimise demand across Cornwall and support the recharge of Colliford reservoir over the winter period. The incentive targeted the Colliford Reservoir reaching 30% capacity by 31 December 2022 and, if the target were achieved, each household customer would be eligible for a bill credit of £30.

'Stop the Drop' was launched through multi-channel communication including social media and radio and promoted via widespread integrated campaigns. See the examples shown belowFigure 18: Stop the drop campaign.

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Figure 18: Stop the drop campaign.

The initiative ran successfully with Colliford reaching 30% storage on the 20 December 2022, as shown in Figure 19 below. As mentioned in a previous response, a 4.6% reduction was seen in Household consumption over the period of the initiative.

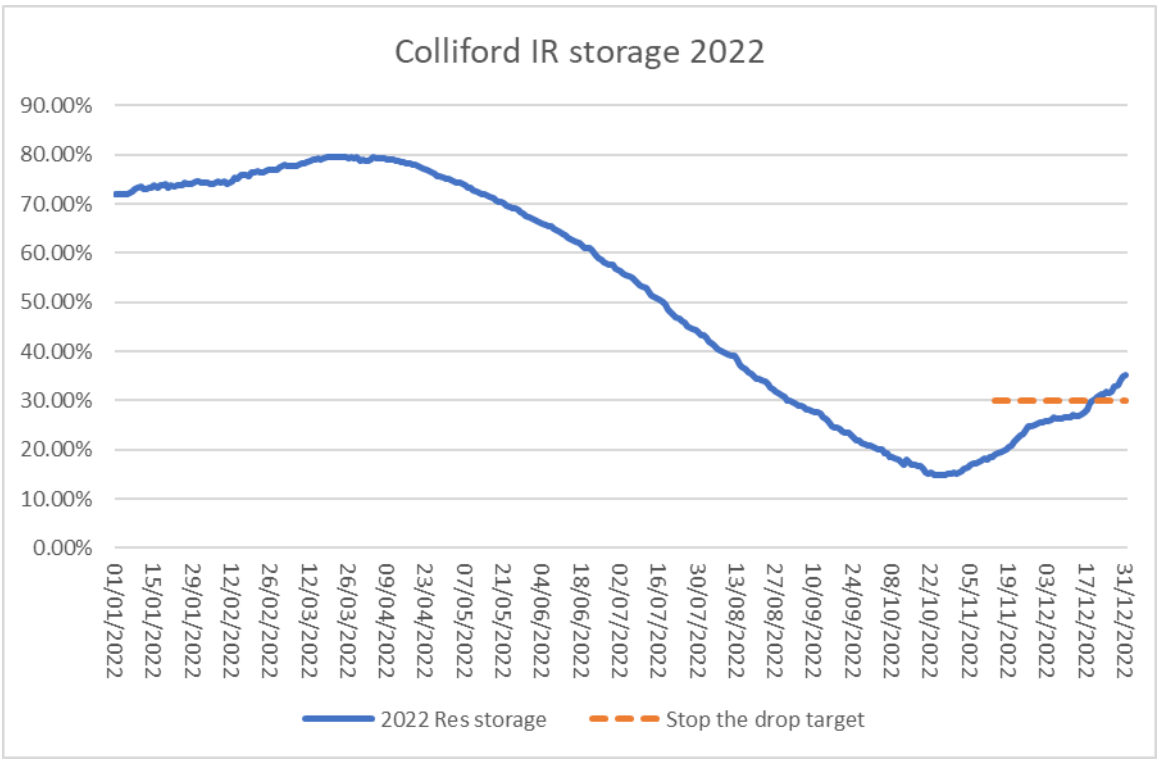


Figure 19: Colliford IR storage

<u>Media campaigns</u>

In summer 2022, we increased our messaging across multiple communication platforms, transit advertising and physical offerings such as street-side posters and leaflets. The outreach increased with the introduction of water use restrictions in Colliford in August.

After the successful conclusion of the "Stop the Drop" campaign, the launched it largest ever marketing and engagement campaign around water efficiency and not just focussed on Colliford. At the start of 2023 "Stop

the Drop" evolved into the long-term customer engagement programme "Save Every Drop", see Figure 2020 below, with messaging broadened to be across Devon and Cornwall.

Figure 20: Save every drop campaign.

The intention was to provide ongoing messaging to 'nudge' customer behaviour to make long-lasting changes in how customers use water and engage with the company on water efficiency. As part of the "Save Every Drop" campaign we are using the key message of 'Ordinary steps make an extraordinary difference' which allows linkage into wider messaging, including on wastewater actions.

As mentioned in another section, Household consumption reduced in 2022/23. Due to the swift implementation of many of the water saving initiatives described above, the latency of meter readings and the Temporary Use Bans introduced in Colliford we continue to quantify the individual savings of each initiative but in combination they will have all contributed to the reduction in Household consumption seen in 2022/23.

2.2.4.2 Non-household water efficiency

In 2022 we continued to engage with our business customers on existing water efficiency activities and significantly increased our range of initiatives. These activities included:

- Working with schools in the Colliford WRZ as part of a joint initiative with the Department of Education. In 2022/23, 44 schools were visited, and interventions and remedial work undertaken at 22 sites. Example interventions include those shown below in Figure 2121.

St Neot Community Primary School	18/11/2022	Fit 26 non-concussive taps in pupil WHBs
St Breock Primary School		Fit thirteen isolation valves to taps in staff WHBs
	15/11/2022	Fit six non-concussive taps in pupil WHBs
St Merryn Primary School		Repair leaking tap in the servery WHB
		Fit eighteen non-concussive taps in pupil WHBs
	15/11/2022	Fit non-concussive mixer tap in pupil WHB
Brunel Primary and Nursery Academy		Fit 9 isolation valves to taps in staff toilet WHBs
		Fix three leaking taps in classroom sinks
		Fit flush valve in 6L dual flush WC in pupil toilets
		Fit flush valve in 7.5L low level WC in pupil toilets
		Fit flush valve in 8L low level WC in pupil toilets
		Fit non-concussive mixer tap in pupil WHBs
	19/10/2022	Fit fifteen non-concussive taps in pupil WHBs
Windmill Hill Academy		Repair leak on isolation valve on tap in servery sink
	11/10/2022	Fit 23 non-concussive taps in pupil WHBs
Coads Green Primary School	11/10/2022	Replace quarter turn & non-concussive taps in WHBs in pupil toilets
Dobwalls Community Primary School		Replace flush valve on 6.5L low level WC in accessible toilet
		Replace flush valve on 7L low level WC in accessible toilet
		Fit 27 non-concussive taps in pupil WHBs
	12/10/2022	Replace flush valve on three 9L low level WCs in pupil toilets

Figure 21: School interventions

- We have introduced a Non-household innovation fund to encourage our commercial customers to proactively think about how they can reduce their consumption. In 2022/23, the fund invited applications from businesses in Cornwall who needed financial assistance implementing new and innovative ways to reduce their demand. The total fund for 2022/23 was £110,000 and the maximum contribution from SWW was £10,000 per customer. To be eligible for the fund the project must save mains tap water and be able to demonstrate a tangible, sustainable reduction in water use (litres/day saved as a result of the project) in specific Postcode areas in Cornwall and deliver a minimum water saving cost benefit that is better than the £1/Litre/day saving from the SWW funding contribution applied for.

  The fund was launched in January, and we had 3 successful applications in 2022/23 including working with Whitbread Ltd to install water efficient equipment at 16 of their sites in Cornwall covering Premier Inn, Brewers Fayre, and Beefeater premises. This fund has now been expanded to all temporary use areas and the format of the fund is being reviewed and updated as we will be continuing the innovation fund, but we want to ensure it focuses on sustainable long-term innovation rather than short-term demand reductions.

- We continue to promote and fund our Community Water Saving fund. In 2022/23 we funded 49 community groups to a total of £125,000 delivering estimated annual water savings circa 116 Megalitres.

- In 2022/23 we started to engage with water efficiency contractors with commercial customer experience, such as Groundworks and H2oIQ, who will be delivering audits and interventions in 2023/24.
- As part of our work to preserve water resources and reduce total demand we will be working with key NHH customers on their water efficiency in 2023/24. We have started to engage with, and will be working with in 2023/24, the University of Plymouth on water efficiency on their academic sites and their halls of residence. We have also started to engage with the private provider of accommodation to the University of Plymouth and the University of Exeter.

2.2.5 The impact of drought on our leakage activities

As mentioned previously, the drought of 2022 brought significant challenges to our leakage management activities. The extended dry weather created variations in soil characteristics, the scale of swell and shrink applied stresses on less resilient pipe materials – Cast and Spun Iron in particular. Despite the challenges and an in-year increase in leakage we were able to maintain our 3-year rolling average performance commitment.

During the summer of 2022, we set up specific projects to increase the focus on leakage management.

2.2.5.1 Increased pressure management activity.

All Pressure Management valves in the Colliford WRZ and the area supplied by Upper Tamar Lake (within our Roadford WRZ) were data logged for the minimum period necessary to determine temporary opportunity to reduce outlet set points without impacting water service or providing pressure less than statutory minimums. Reducing pressure supports the reduction of total distribution input and leakage. A total of 750 valves were assessed and approximately 125 suitable strategic, high population valves were reduced. Overall, we estimate the pressure setpoint reductions to have reduced demand by up to 1Ml/d.

2.2.5.2 DMA optimisation and enhanced active leakage control.

Detection resources were increased to target DMAs with the greatest opportunity to reduce leakage and daily demand further. The resources were deployed to work exclusively in the Colliford supply zone.

A comparison of leaks detected and reported in Colliford and Roadford is included below in Table 7, showing our increased detection activity.

Type of Leak / Area	FY 2021/2022 Total	FY 2022/2023 Total
Colliford Leaks Detected	2646	3627
Colliford Leaks Reported	2717	2973
Roadford Leaks Detected	4368	5204
Roadford Leaks Reported	4386	4561

Table 7: Colliford & Roadford leakage activity

2.2.5.3 Customer leakage

In 2022 we expanded our funded private leak repair and pipe renewal offering to customers. Historical intervention thresholds were removed so all leaks either inspected/ detected by technicians were repaired via a dedicated repair framework procured with a local repair company. The total of leakage saved by repairing or replacing customer pipework we estimate to be around 21 Ml. This was achieved by repairing ~1,300 customer leaks, with 22% of all free interventions being full replacement of the supply pipe. Spot repair verses full replacement is determined by the local detecting technician and repairing operative. The pipes propensity for more leakage, typically based on pipe material, observed condition and operating

pressure, is assessed and the activity adjusted for most longevity and cost outcome. Leaks repaired and funded by SWW were 35% greater in 2022/23 than the previous year.

Other leakage activity we initiated in 2022 in response to the drought included:

- Upstream Losses project - this looked at reducing leakage in trunk main DMAs in the Colliford Zone.
- Summer Incentive for leak detectors to drive leak location and promotion.
- Focus on keeping our number of outstanding leak repairs with Kier, our repair partner, below 200 on any day.

2.2.6 The impact of drought on our metering activities

Through our extensive research and customer engagement, customers have told us that metering is the fairest way for households to pay for what they use; however, they still value the choice to switch. Metering saves customers on average a 15% reduction in their annual bill. This increases when customers are supported by water efficiency messaging, education and free water saving devices. We have a high meter penetration so our increased water efficiency activities in 2022 will have had a greater impact on managing demand.

In part due to the historically higher charges in the South West, over 87% of SWW customers are currently charged on a metered or equivalent basis through customer appetite alone. The trend in new meter installations and the appetite of customers to switch is reduced at such high levels of meter penetration. However, through the Green Recovery Funding and Accelerated Infrastructure spend agreed with OFWAT we are accelerating the deployment of AMI smart meters in Colliford and Roadford which will give customers even more opportunity to reduce their bills through increased awareness of their consumption behaviour. These smart meters also increase our ability to engage with customers on water efficiency.

2.2.7 The impact of drought on our own activities

In 2022 our initiative to reduce the use of potable water at company wastewater treatment works, for example, for the persistent cleaning of screening equipment was increased. Water is required to remove materials and products that can impact downstream processes. With very basic filtration, storage and pumping, final effluent can be used to effectively wash screens. At several high potable water consuming wastewater sites, we installed equipment to return final effluent to the screening systems. 1.421Ml/d was saved in the year 2022/23, 70% of the benefit coming from final effluent return to screen wash systems and the rest from repairing and replacing leaking pipework onsite.

2.2.8 The implications of the drought demand for our WRMP

2.2.8.1 Water efficiency

Many of the water efficiency activities we implemented with our household and non-household customers as part of our drought response in 2022 we are continuing as BAU water efficiency activity into the next 25 year period. This includes continuing our household audits, supply of water saving devices and engagement with our tourism and education-based commercial customers.

The consumption benefits from these BAU activities have been included in our demand forecast baseline. As we move into AMP8 and increase our water efficiency activities towards achieving our long-term demand reduction targets there will be clear separation between BAU and the enhanced activities when we report on our progress against our WRMP24 plan.

2.2.8.2 Demand scenario testing

The demand recorded in 2022 during the drought was above our WRMP19 forecasts. In Appendix 2 (Forecasting Demand) we describe how we have estimated the long-term impacts of COVID-19, for example, as a small long-term increase in household consumption. Many people are beginning to return to the office and activities such as increased hand, clothes and packaging washing are declining. However, the impact of COVID-19 alone does not fully describe the higher demand we saw in 2022. We expect that the weather during the 2022 drought, days without rainfall and high temperatures, were key triggers for

increased garden watering and external water use. Gardens have become more highly valued since the pandemic, strengthening the existing link between low rainfall and increased demand.

Due to the uncertainty these factors bring to our demand forecast, we have expanded our demand scenario testing beyond the OFWAT common reference scenarios - demand adverse and demand benign scenarios. In Appendix 6 we describe our company specified “Demand Plus”, “Demand Plus Plus” and “Demand Plus Plus Plus” which we have included in response to the 2022 experience. The scenarios are further described in Appendix 6 but to summarise;

- Demand Plus: Demand is increased by 0.5x the difference between our WRMP19 forecast and 2022 actual demand.
- Demand Plus Plus: Demand is increased by 1x the difference between our WRMP19 forecast and 2022 actual demand.
- Demand Plus Plus Plus: Demand is increased by 1.5x the difference between our WRMP19 forecast and 2022 actual demand.

These extra scenarios cover a wider range of potential futures, which allows us to effectively test our Best Value plan and confirm the chosen pathway for our final WRMP.

2.3 Water Resources Impact

The impacts outlined in the previous sections on supply and demand combine to have an overall impact on our water resources position. This section summarises the overall water resource impacts in each WRZ during 2022.

2.3.1 Colliford WRZ

Of all our WRZs, Colliford experienced the most severe impact on its water supply during the 2022/3 drought. Colliford reservoir experienced a record drawdown in response to unprecedented demand driven by the high temperatures and very low rainfall. One of the driving factors is that it is prone to multi-season impacts where the reservoir doesn’t fully refill over winter and it was only around 80% full at the start of 2022.

Colliford Reservoir provides the strategic back up to our local sources and can supply water throughout the WRZ via Restormel water treatments works (WTW). The early start to the drought in March 2022 meant that our local sources became constrained early in the year and Colliford Reservoir was called upon sooner than in a normal operating year.

Colliford Reservoir releases water into the River Fowey from which we then abstract at Restormel. The volume of release is dependent on the river level in the River Fowey. In 2022 our releases from Colliford Reservoir started in April and did not cease until the end of October (**Error! Reference source not found.**). This was a record year of releases both in timing and in total volume, leading to Colliford Reservoir reaching its lowest level ever of 14.8% on 25th October 2022.

We implemented a Temporary Use Ban (TUB) in August 2022 in accordance with our Drought Plan (as outlined in section 3.2.1).

We experienced good recovery of Colliford Reservoir during winter 2022/23 aided by our Stop The Drop campaign (see section 2.2.4) helping to reduce demand and the Restormel drought permit (see section 3.3.1) which helped boost our pump storage from Restormel to Colliford.

Despite this good recovery, Colliford Reservoir started the 2023 drawdown at 70%, 10% lower than in 2022. This presented an ongoing risk of supply to our customers until we could be confident that 2023 would not present another risk of drought. The TUB remained in place until September 2023.

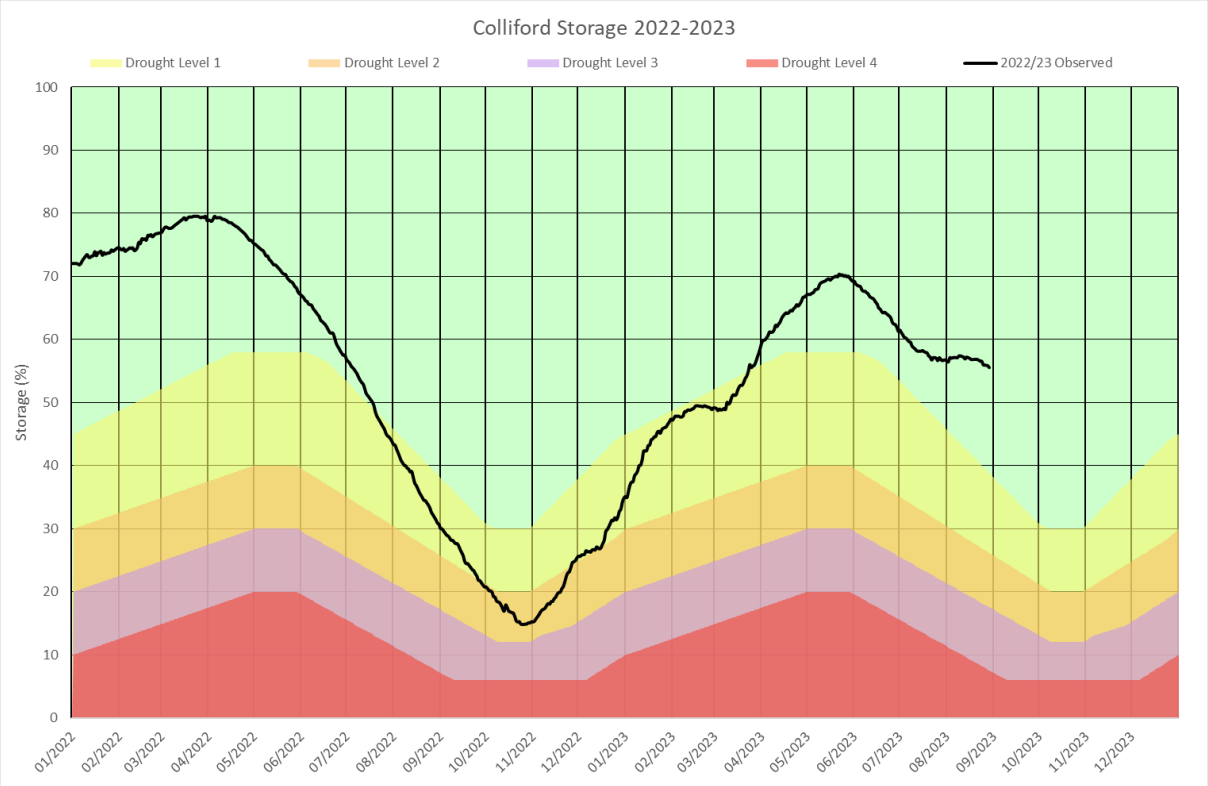


Figure 22: Colliford Reservoir storage 2022 and 2023.

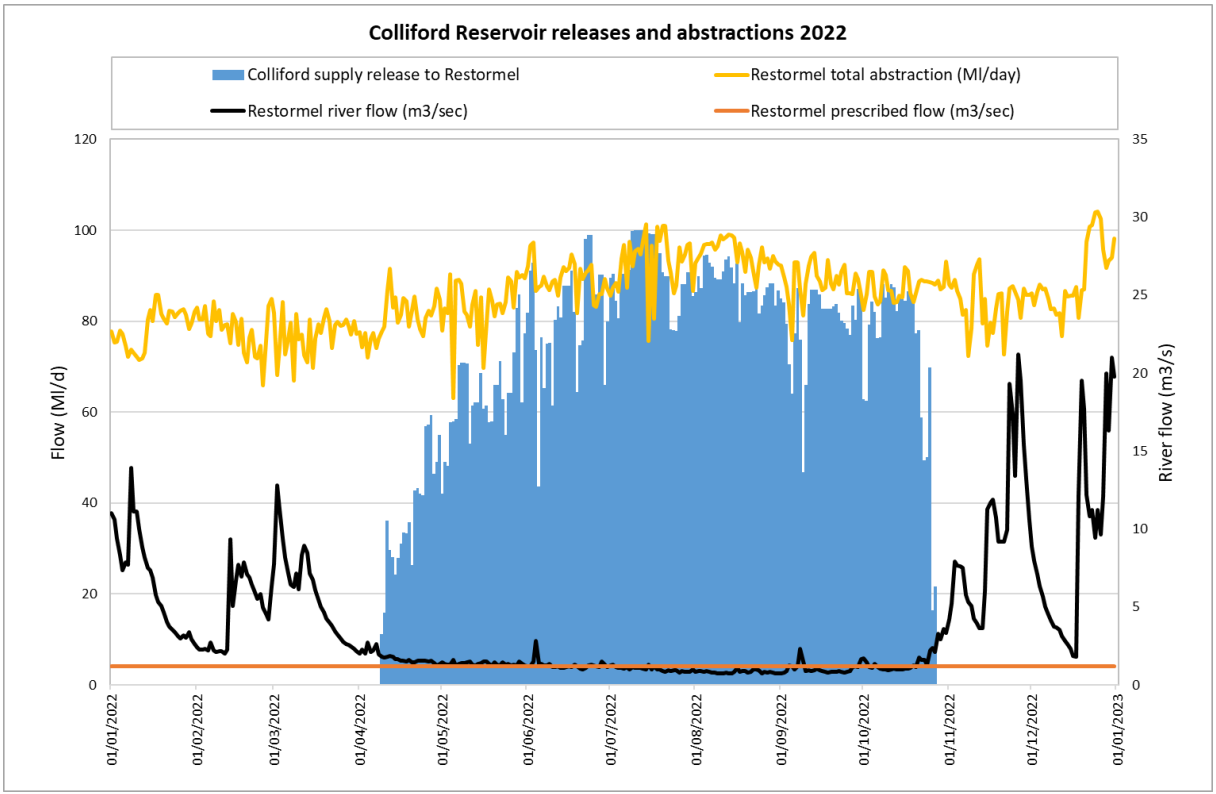


Figure 23: Colliford Reservoir releases in 2022 (solid blue) compared with river flows (black line) and our abstraction (yellow line)

2.3.2 Roadford WRZ

The most significant impact during 2022 in Roadford WRZ was in the Upper Tamar area of the WRZ which required its own local TUB to be implemented in September 2022 and a drought permit for Upper Tamar Lake (see section 0). The detail of this is outlined further in section 3.2.2 with an explanation of the causes and how we managed and mitigated impacts.

In the wider Roadford WRZ the local sources of water are all backed up by Roadford Reservoir. The reservoir experienced a record drawdown of 66.5% of its volume dropping from 100% full at the start of the year to a minimum of 33.5% on 28th October 2022 close to the bottom of drought level 1. Similar to Colliford Reservoir, Roadford experienced a record period of release to support abstraction from the River Tamar at Gunnislake. These releases started in mid-May and did not cease entirely until mid-October.

Roadford provides a year-round supply of water to our Northcombe WTW of around 50 Ml/d. This means that during periods of dry weather, when reservoir inflows are lower, storage starts to drop. Figure 34 This meant that over winter 2022/23 the periods of good recovery were interspersed with periods of further storage drawdown. The highest level reached in May 2023, prior to summer drawdown, was 69.9%. This was assisted by the use of a drought permit on the River Lyd allowing the new pump-storage scheme to recharge Roadford through to the end of May (see section 0).

Reservoir storage reached drought level 2 in February 2023 and we implemented a Temporary Use Ban (TUB) in April 2023 in accordance with our drought plan (as outlined in section 3.2.3). The remained in place until 25th September 2023.

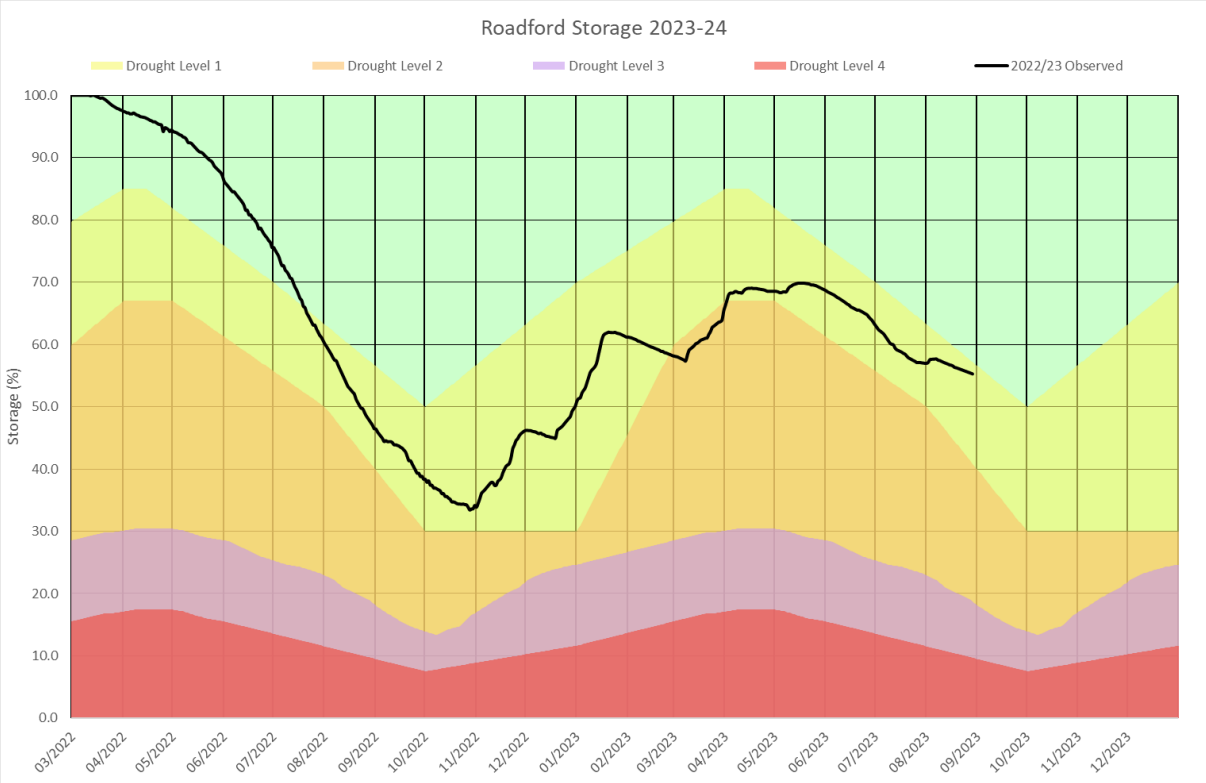


Figure 24: Roadford Reservoir storage 2022 and 2023.

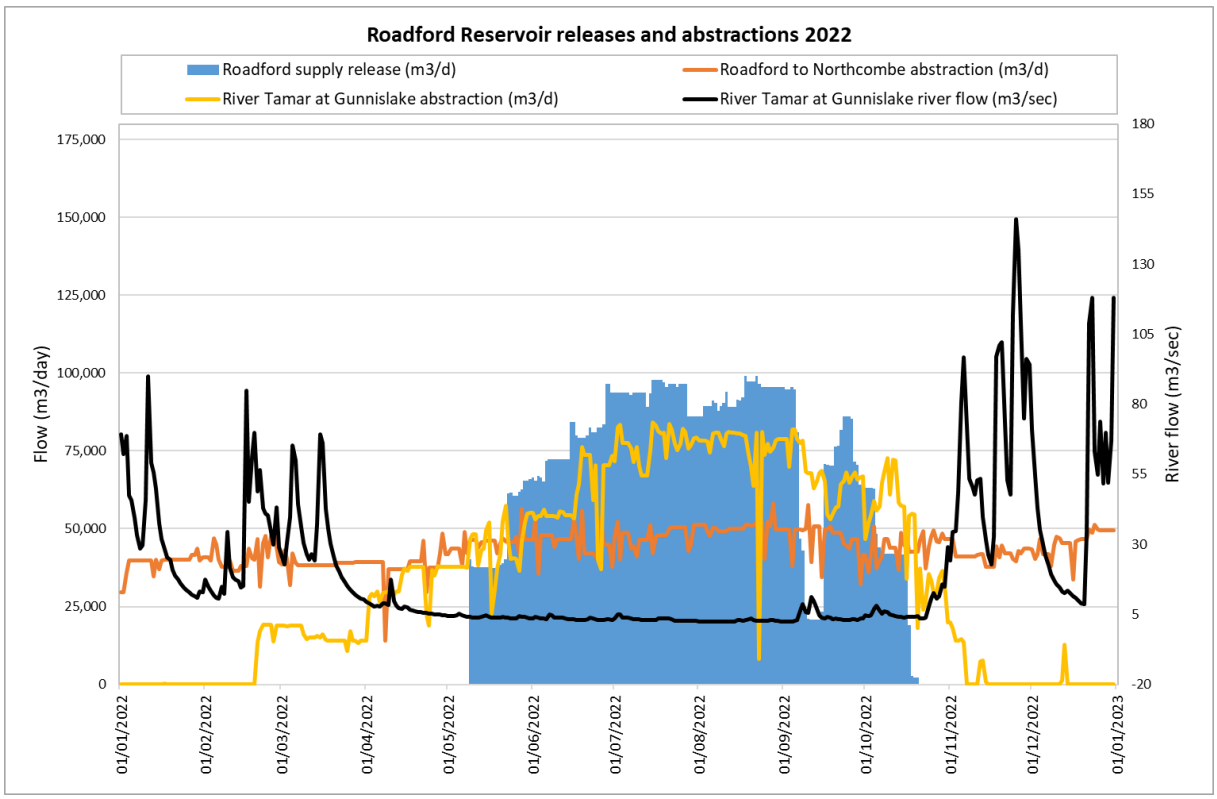


Figure 25: Roadford Reservoir releases in 2022 (solid blue) compared with river flows (black line) and our abstraction (yellow line)

2.3.3 Wimbleball WRZ

Wimbleball WRZ is dependent on Wimbleball Reservoir to maintain supplies across the WRZ when other sources are low or become constrained. Wimbleball Reservoir experienced its largest single season drawdown from 100% to a minimum of 17.2% on the 22nd October 2022 remaining in drought level 1. The recovery of Wimbleball Reservoir over winter 2022/23 was rapid, reaching 50% capacity in December and 100% capacity by the end of January. The recovery of Wimbleball Reservoir is aided through the winter pump storage scheme allowing water from the River Exe and Exebridge to refill the reservoir.

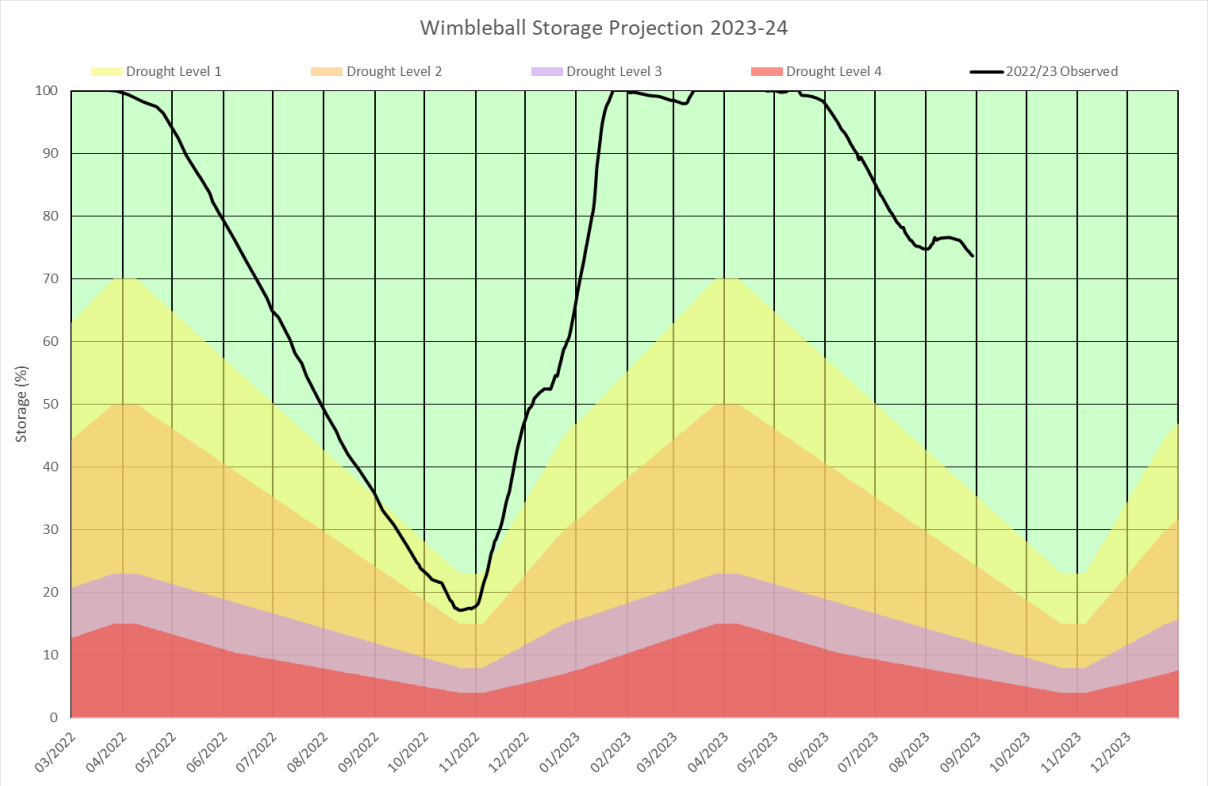


Figure 26: Wimbleball Reservoir storage 2022 and 2023.

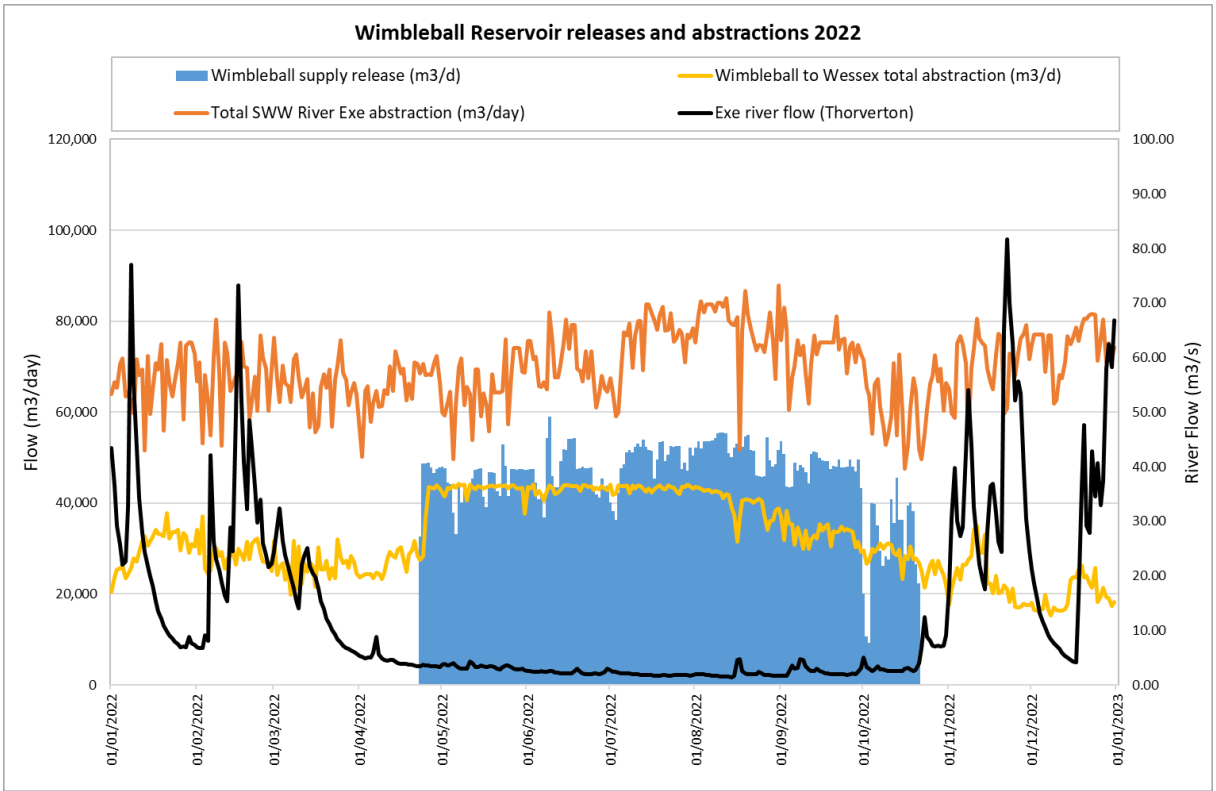


Figure 27: Wimbleball Reservoir releases in 2022 (solid blue) compared with river flows (black line) and our abstraction (yellow line)

2.3.4 Bournemouth WRZ

Bournemouth WRZ is predominantly supplied by the River Avon and River Stour which both have a significant groundwater component supporting the river baseflows. This supports their resilience to single drought events and river flow levels did not drop low enough to causes any concerns to supply during 2022. We monitored demand in the WRZ to ensure our water treatment works capacity can deal with customer demand, this is shown in **Error! Reference source not found.**.

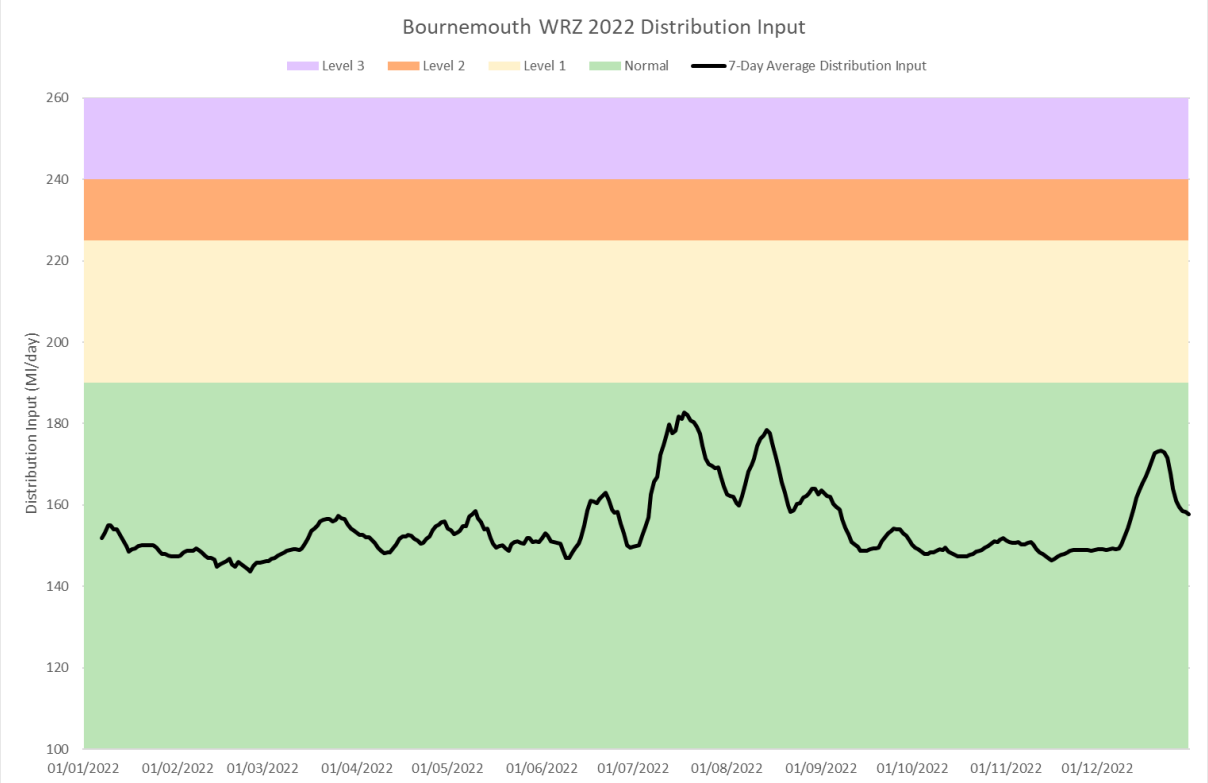


Figure 28: Bournemouth WRZ distribution input and our drought plan levels.

2.3.5 Isles of Scilly WRZ

The Isles of Scilly WRZ is geographically very small meaning it is very reliant on the rainfall that falls over this small area. The 2022 drought saw limited rainfall on the islands over summer, similar to the mainland. This saw groundwater levels reduce across the islands causing some concern with localised issues at particular groundwater sources. At the end of September, rainfall saw good short-term recovery in groundwater levels (see Figure 29) which coincided with the end of the summer tourism season and a reduction in the overall demand for water.

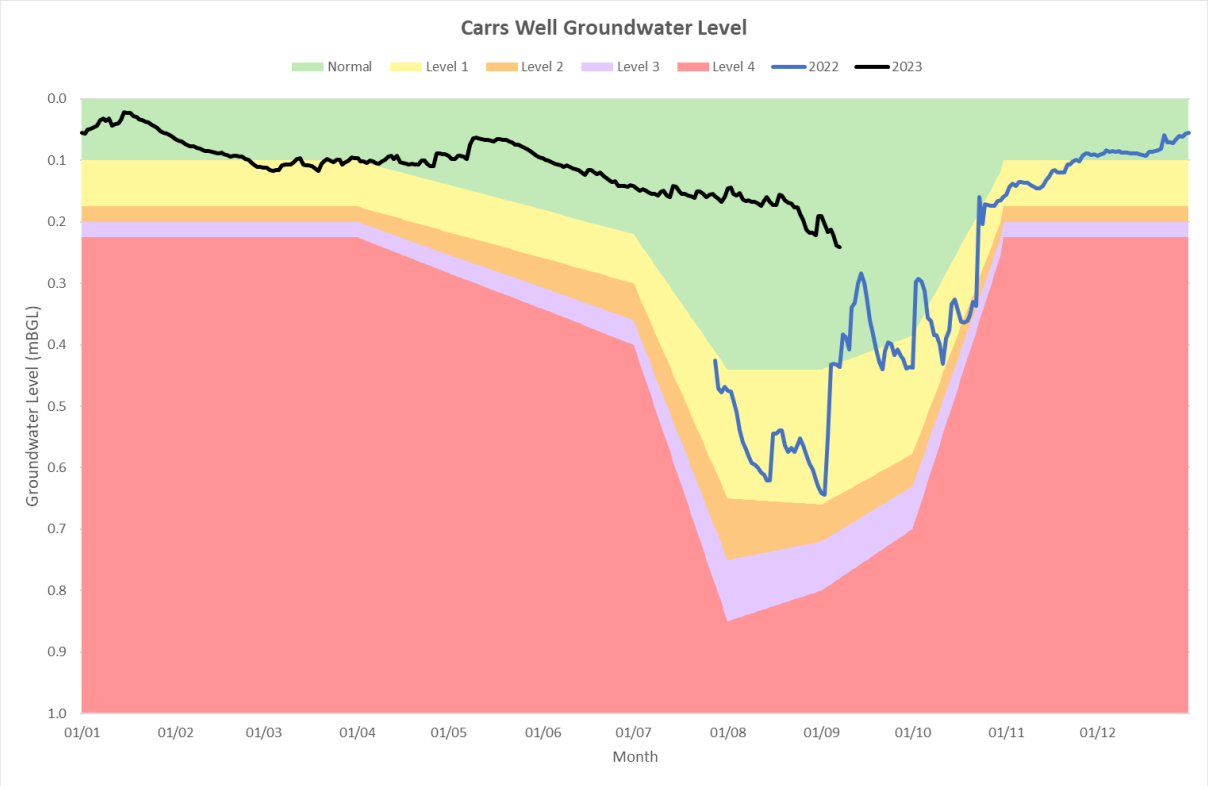


Figure 29: Groundwater level at Carrs Well on St Marys

3 Successful Implementation of our Drought Plan

We submitted our final Drought Plan to DEFRA early in 2022 and it was subsequently approved for publication. The Drought Plan provided a strong basis for formulating our response to the challenges which arose in 2022. Our response began with increased media campaigns and direct customer engagement events, through the deployment of TUBs and into the application of drought permits.

The following section explains further learning from the implementation on our drought plan covering:

- Evidence to demonstrate that our **supply model is robust.**
- The impact and learning from implementing TUBs in the Colliford zone.
- Explanation behind **the need for TUBs in the Upper Tamar area**.
- Explanation behind **the need for TUBs in the Roadford zone**
- Information on the **Drought Permit application within the Colliford and Roadford Zone**.
- The **importance of Environmental Assessments**, to inform the feasibility of supply-side options.

3.1 Water Efficiency and Media Campaigns

3.1.1 Our water efficiency drought response

Our increased water efficiency activity in response to the drought of 2022/23 is described in section 2.2.4.

3.2 Implementation of TUBS

Over the course of the 2022/23 drought, we implemented TUBs in two phases across our Colliford and Roadford WRZs. This section provides an overview of each of these phases in the respective WRZs.

3.2.1 Colliford WRZ – August 2022

In line with our Drought Plan we introduced a Temporary Use Ban (TUB) in Colliford WRZ on the 23rd August 2022. This decision was taken based on the position of Colliford Reservoir at the time but took into account the persistent high level of demand, the position of local reservoirs which were also depleted and our forward projections which highlighted the potential risks to water supply if we did not take action. The TUB remained in place until 25th September 2023.

We examined the impact of the TUB in Colliford WRZ on demand to validate the assumptions we have made on TUB benefits for our dWRMP.

It can be difficult to precisely ascribe individual volumetric benefits to any individual demand-side activities. For example, the implementation of TUBs in Colliford coincided with a change in the weather, lower temperatures and more overcast days. The figure below sets out the daily demand from the District Metered Area's (DMAs) supplied by Colliford and illustrates an approximate 10% reduction since the TUB was announced on the 15 August 2022. The second figure compares the distribution input over 2022 with 2021 and 2017. The announcement of a TUB on 15 August 2022 is shown by the line marked "B".

Daily demand for Colliford WRZ following the announcing of the TUB on 15 August 2022 to mid-October 2022 is shown below.

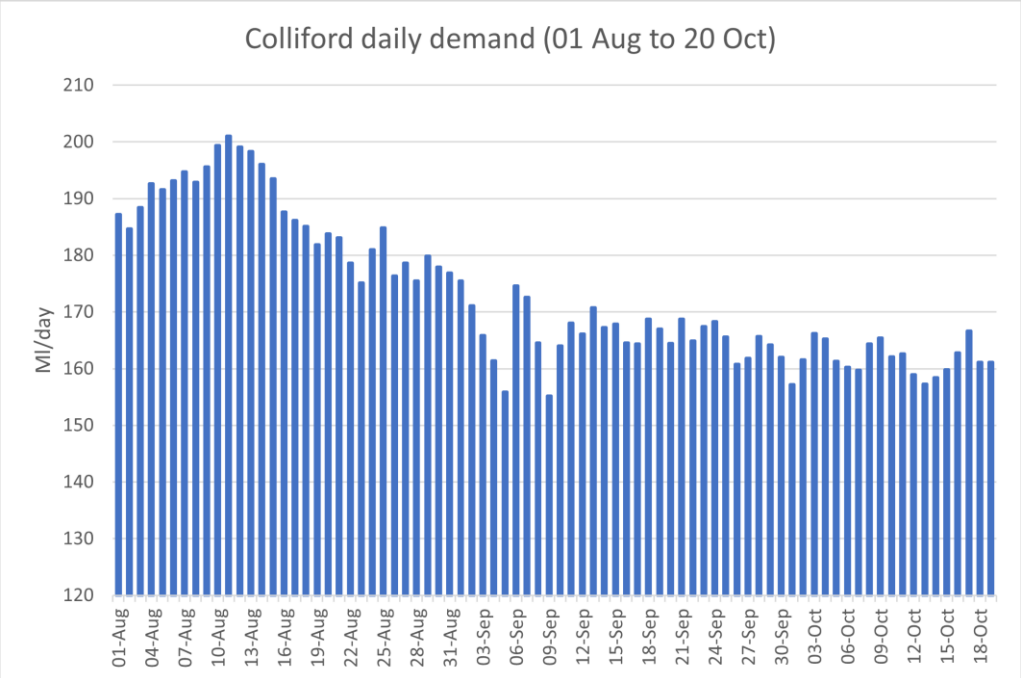


Figure 30: Daily demand for Colliford since TUBs introduced in August 2022

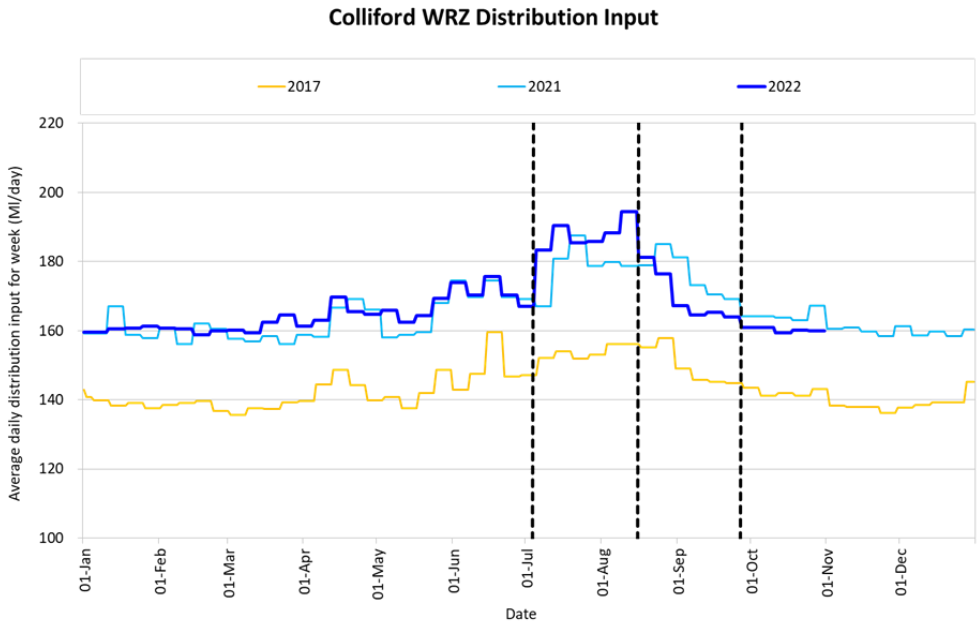


Figure 31: Distribution input for Colliford WRZ comparing 2022 with 2021 and 2017.

Previous studies estimate that an approximate 7% reduction in demand can be achieved from TUBS and associated media campaigns. The data available suggests that we experienced an actual reduction slightly below this amount in the order of around 4%, but this is highly uncertain and difficult to ascribe. In our revised dWRMP we assume a reduction of 5% from TUBs, given the uncertainty in the estimate.

3.2.2 Upper Tamar – Roadford WRZ – August 2022

At the same time as the Colliford WRZ TUB we also implemented a TUB in a small part of our Roadford WRZ in the area supplied by Upper Tamar Lake. This area of Roadford WRZ receives its primary supply from Upper Tamar Lake with additional resource provide from Roadford Reservoir via the Northcombe water treatment works (WTW).

During the 2022 drought the demand in the Upper Tamar area reached unprecedented levels leading to a significant drawdown of the Upper Tamar Lake. At the time we could not transfer enough water into this area from Northcombe WTW to provide the resource we needed.

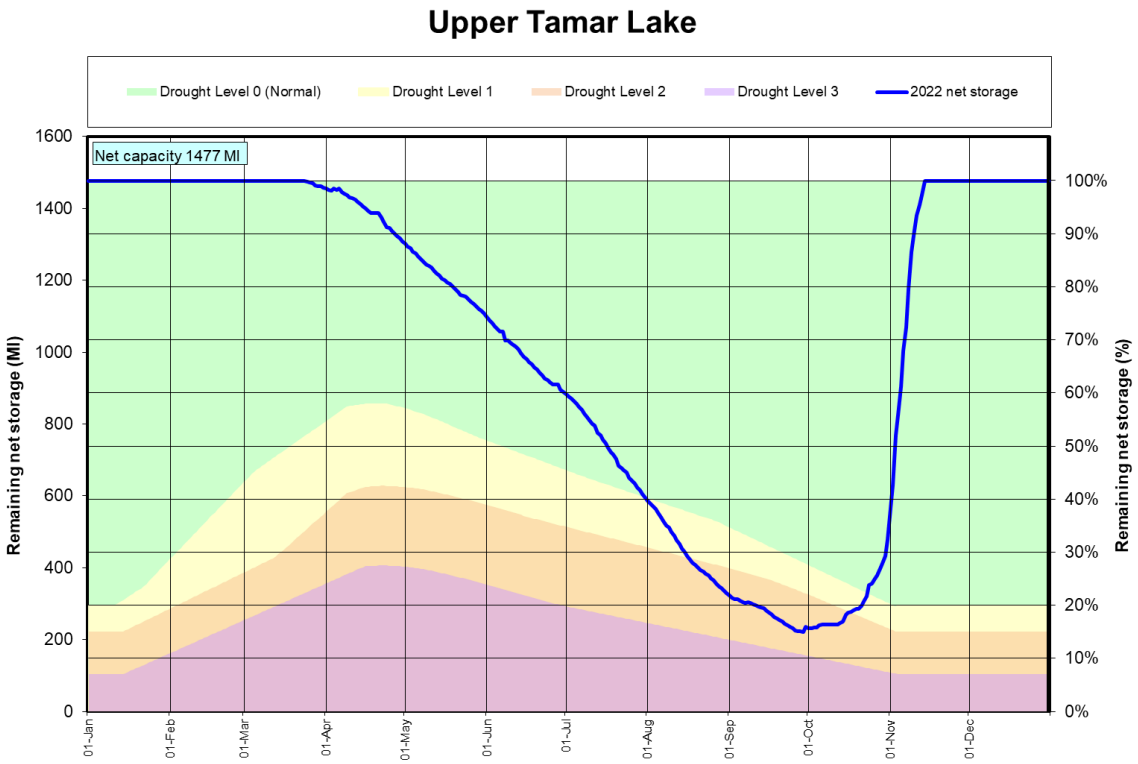


Figure 32: Upper Tamar Lake level during the 2022 drought.

In response to the resource position in Upper Tamar Lake and the imposition of a TUB on our customers in this area we undertook two supply interventions:

1. The application of a drought permit for the Tamar Lakes (as outlined in section 0)
2. Changes to our distribution network to allow more water to be transferred into the supply area from Northcombe WTW.

The changes to our distribution network increased pumping capacity at Brandis Corner, near Holsworthy, during Summer 2022 to allow additional treated water to be imported into the area from Northcombe WTW. This allows an additional 2 Ml/d to be transferred into this area which is shown in the figure below.

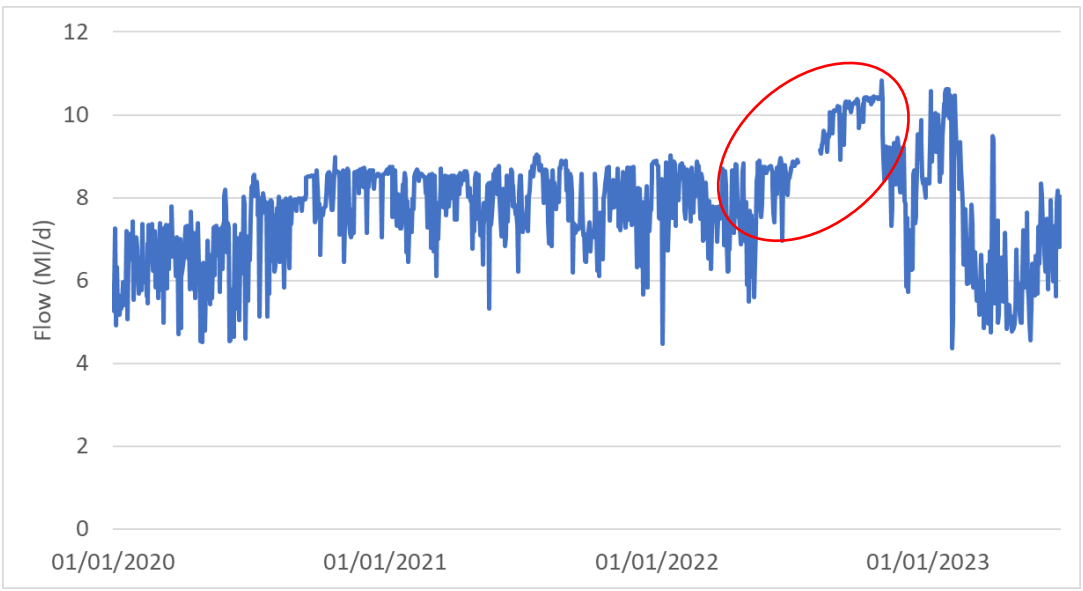


Figure 33: Changes in treated flows entering the Upper Tamar supply area.

3.2.3 Roadford WRZ – April 2023

In line with our Drought Plan we introduced a Temporary Use Ban (TUB) in Roadford WRZ on the 25th April 2023. Roadford reservoir reached a minimum level of around 35% in October 2022 before it started to refill from November. Over the course of the winter 2022/23 there were several periods of low rainfall, notably in December and from mid-January to the start of March. These are summarised graphically in Figure 34.

The period of low rainfall in early 2023 meant that Roadford Reservoir dropped 5% in storage during a period where we would have expected storage to go up. This caused Roadford Reservoir to cross the Level 2 drought control curve at the end of February. In line with our drought plan this Level 2 threshold leads us to consider implementing a TUB which was required to mitigate risk to supply during 2023 if we experienced a dry summer. The TUB remained in place until 25th September 2023.

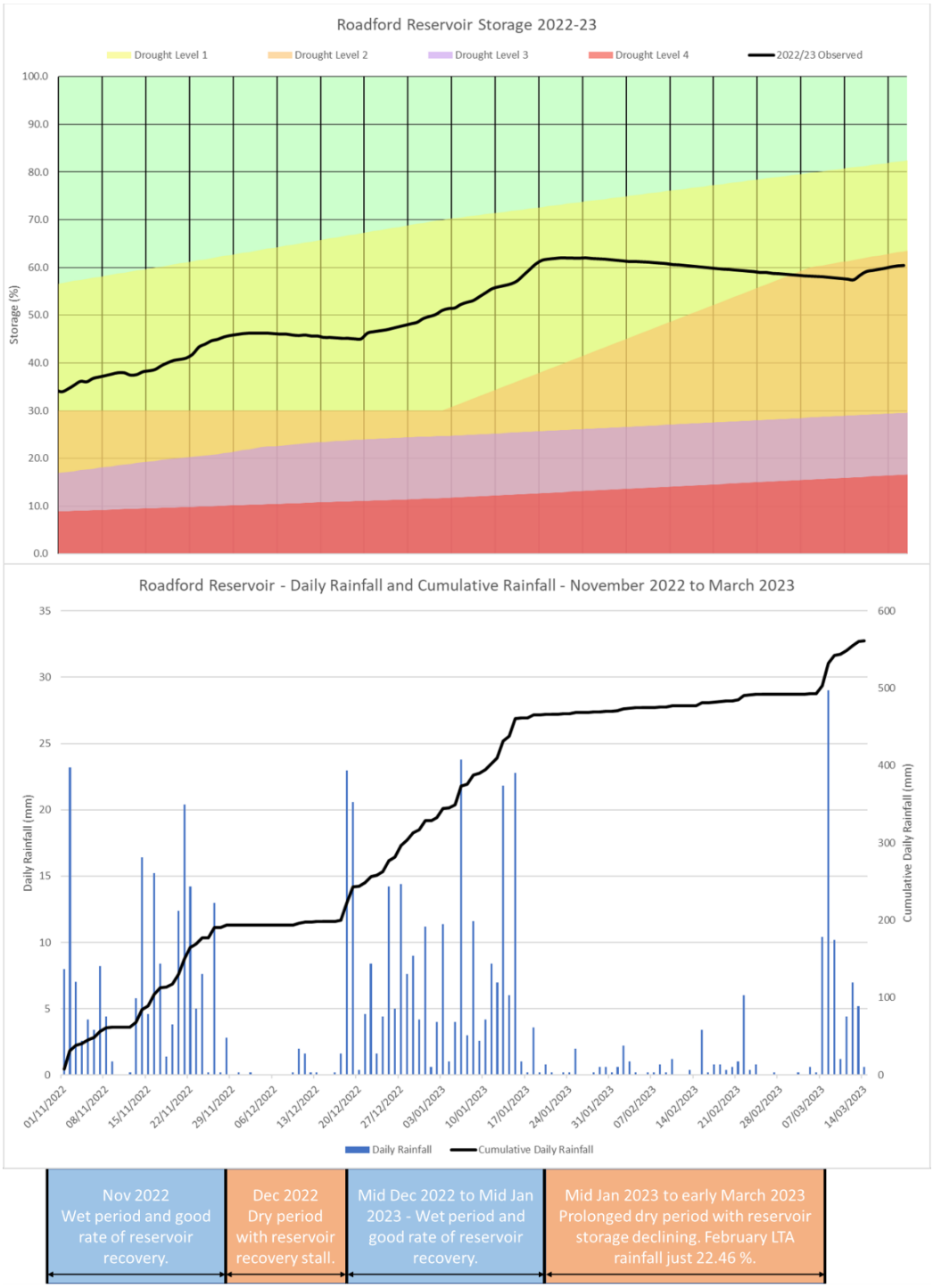


Figure 34: November 2022 to mid-March 2023 showing the Roadford Reservoir storage (top panel) and daily rainfall and cumulative daily rainfall (bottom panel).

3.3 Drought Permits

As part of our drought management actions outlined in our Drought Plan, we applied for a number of drought permits which change the way we operate our water resources system. These typically allow us to use our existing water sources differently or provide entirely new sources for us to abstract water from.

3.3.1 Colliford WRZ

Our Colliford WRZ was most severely impacted by the 2022 drought. An overview of the drought permits we applied for and the periods they operated for is provided in Table 8.

Table 8 Overview of Colliford WRZ drought permits.

Name	Description	Start	Stop
Restormel – River Fowey	Increase to our existing annual abstraction licence to facilitate additional pumped storage to Colliford Reservoir.	01/11/2022	31/03/2023
Stannon Lake	Increased existing daily abstraction from Stannon Lake.	11/11/2022	31/03/2023
Park Lake	Increased existing daily abstraction from Park Lake.	18/11/2022	30/04/2023
Hawks Tor	New abstraction from Hawks Tor De Lank water treatment works and direct to Colliford Reservoir.	12/12/2022	30/04/2023

Table 9: Overview of Colliford WRZ drought permits.

3.3.2 Roadford WRZ

Our Roadford WRZ was severely impacted by the 2022 drought. An overview of the drought permits we applied for and the periods they operated for is provided in Table 11.

Table 10 Overview of Roadford WRZ drought permits.

Name	Description	Start	Stop
Upper Tamar Lake	Cease compensation flows from Upper Tamar Lake and replace with pumped water from Lower Tamar Lake that is recirculated.	29/09/2022	24/11/2023
River Lyd	Operation of our River Lyd pumped storage scheme to Roadford Reservoir outside of normal operating windor of November to March.	26/04/2023	31/05/2023

Table 11: Overview of Roadford WRZ drought permits.

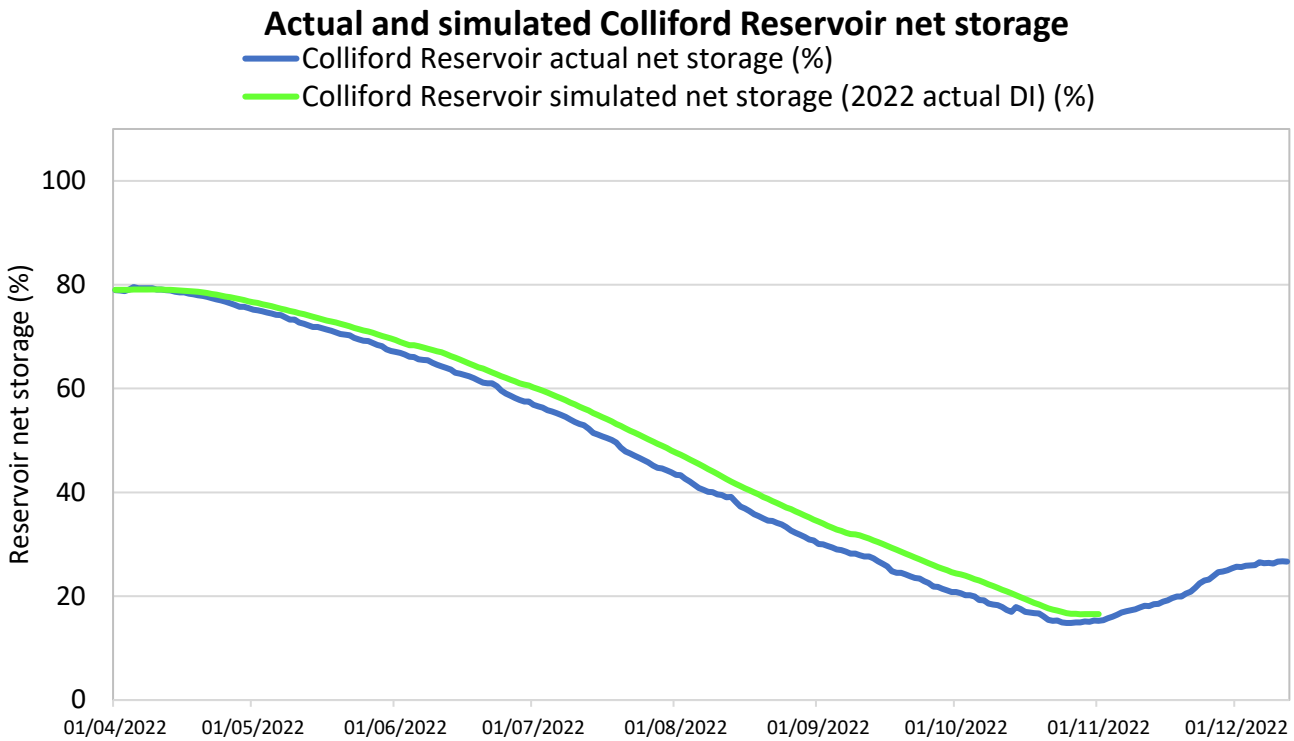
3.4 Robust supply modelling

Throughout the drought of 2022 we used our MISER water resources model to forecast our expected water resources position under a range of scenarios (both weather and operational). We used these forecasts to support our decision making as part of our Drought Plan response and also to optimise our use of sources depending on their resource availability.

We undertook an exercise, back casting observed reservoir levels against those predicted in our supply modelling software using actual demand to check its accuracy. The results show that modelled figures are within a few percentage points of observed figures during the year. Part of this difference will be explained

by evaporation which is not included in our models. We are planning to review our water resources modelling capability after WRMP24 and will consider evaporation losses as part of this review.

We conclude that our models are valid for WRMP modelling.



MI difference between actual average monthly storage and simulated average monthly storage:

Apr 22 - 0.44 MI	Jul 22 - 3.80 MI	Oct 22 - 2.58 MI
May 22 - 1.76 MI	Aug 22 - 4.02 MI	
Jun 22 - 2.59 MI	Sep 22 - 3.88 MI	

Figure 35: Plot showing actual and simulated Colliford reservoir storage.

3.5 Update Our Drought Plan

The drought of 2022/23 was the first year we required to use of the drought management actions outlined in our Drought Plan since the drought of 1995/96. Having worked through our drought management framework in practice over the last 18 months we recognise that some elements of our Drought Plan worked well and some elements did not. We have learnt a lot from our experience of 2022/23 and it is right that we take the time to review our Drought Plan in light of our experiences. Some elements that are directly linked to WRMP24 have been reviewed as part of the development of the WRMP. For example, we have reviewed the benefits that we expect to achieve from our Drought Permits in Appendix 1 Section 10. We will review our entire drought plan commencing in Winter 2023/24 once we have completed our WRMP to ensure it is fit for purpose to manage future drought events going forward.

4 Our Drought and Resilience Program

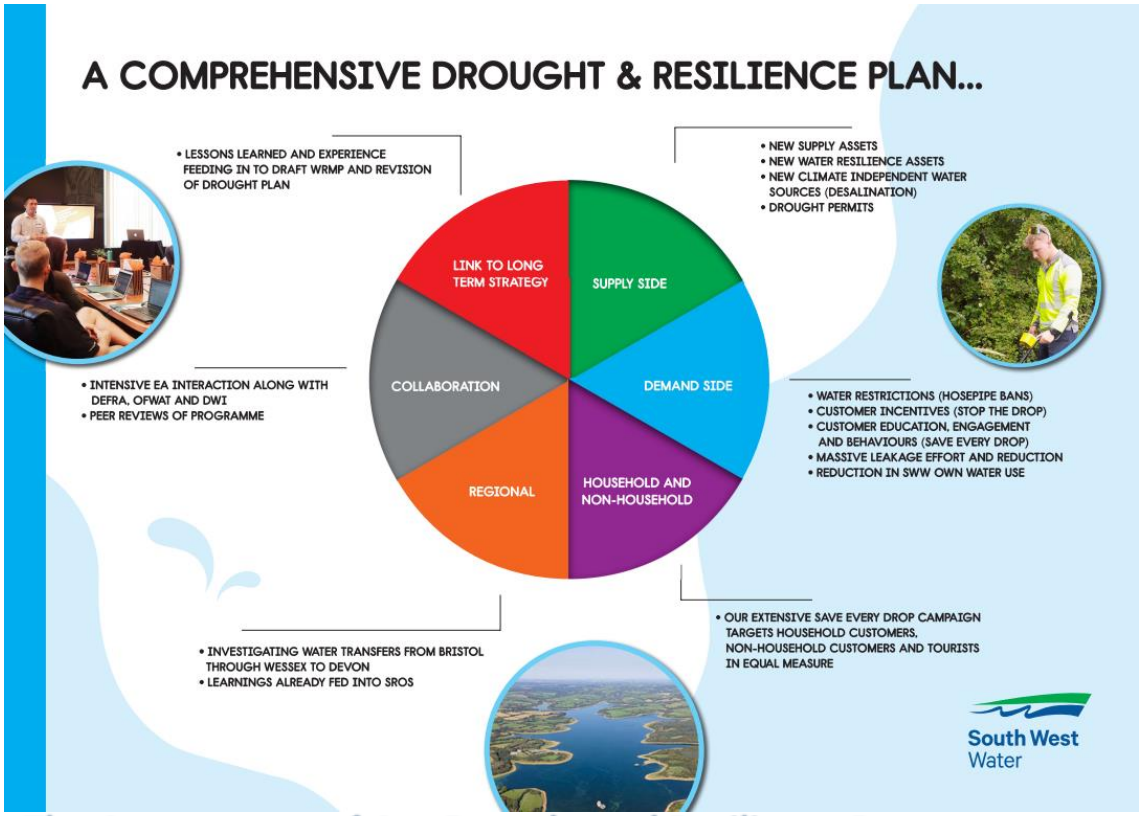
4.1 Drought and Resilience Program Overview

In early January 2023, we transformed from an “incident” mode of operation to a “project” mode of operation in relation to drought and resilience. This coincided with the establishment of our Group Drought and Resilience Programme.

Our Drought and Resilience Programme is aligned to our longer-term water resource objectives. In this regard we have brought forward options from our longer-term plans to make our water supplies resilient.

We have also included our drought water supply measures such as the interventions that will provide additional water in 2023.

Importantly, our Drought and Resilience Programme addresses both supply and demand and Business Continuity. The conceptual derivation of our plan and the elements of our Programme are illustrated below.



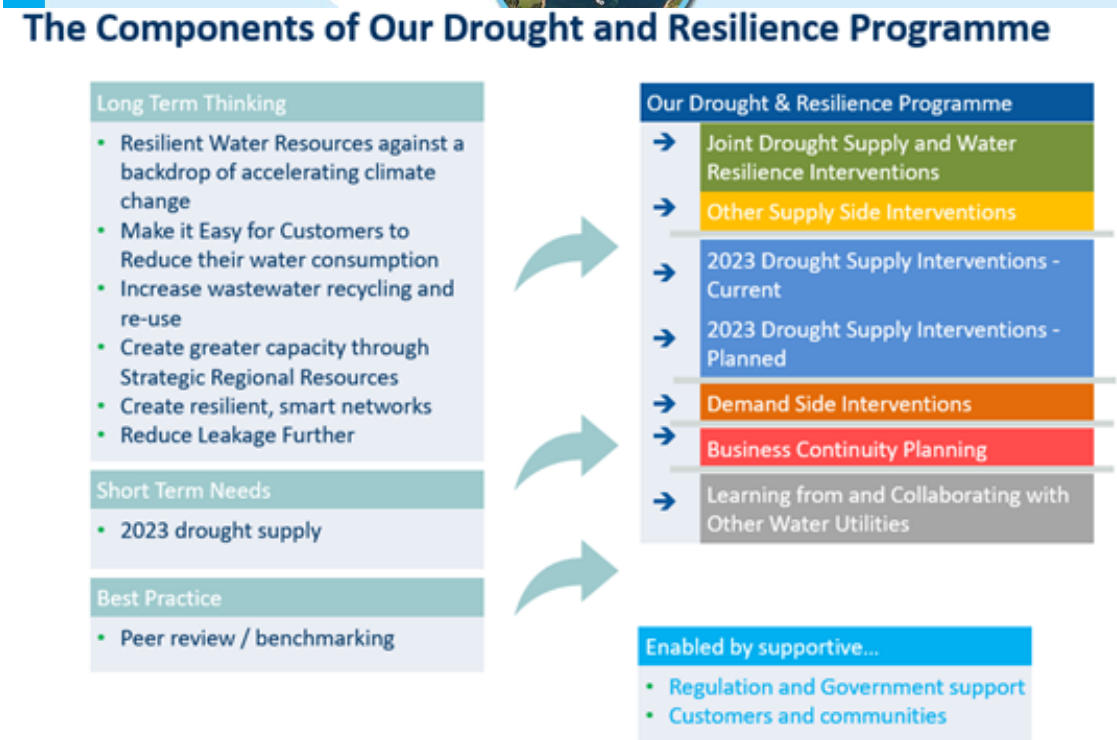


Figure 36: Drought & Resilience program overview

Our Drought and Resilience Programme has two objectives. Broadly described, they are to ensure supply through 2023 and to recover our storages before the 2024 draw downs so that we break the "drought cycle". Specifically, our Drought and Resilience objectives are:

- To ensure that Colliford WRZ and Roadford WRZ do not drop below Drought Level 2 prior to 30 November 2023; and
- To ensure that by 31 March 2024 Colliford and Roadford strategic storages both reach 90% storage to ensure that we do not have the risk of either dropping into Drought Level 2 during 2024 and therefore that we break the "drought cycle".

Our combined demand and supply interventions support these objectives. The intervention volumes we calculated to achieve these objectives are based on 95th percentile "dry" inflows for the 30 November 2023 target and 75th percentile "dry" inflows for the 31 March 2024 target.

4.2 Drought and Resilience Program Schemes

4.2.1 Permanent Schemes and Licences

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 high temperatures and very low rainfall.

One of the driving factors is that Colliford 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, we need to have a greater diversity of sources so that it can be managed as a 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 and 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 the 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 desalination, 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 the 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.

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.

To 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 to 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.

4.2.2 Drought Permit Ready

The drought permits we utilised in 2022/23 were the first time we were required to use any drought permits in 26 years. Our experience of developing the evidence base to support our applications highlighted the need to ensure we capture this evidence in advance of needing to apply for a drought permit so they can be implemented quickly and efficiently for both the water company and the Environment Agency.

We are undertaking Environmental Assessment Reports (EARs) for our permits which establish the baselines against which they are assessed and identify the monitoring and mitigation plan that would be required whilst a permit is in operation. We are liaising with the EA as part of this process to ensure we reach an agreed "permit ready" position.

5 Lessons Learned

As noted above the South West has been drought declared by the Environment Agency right up until the beginning of October 2023. We have learned lessons throughout this whole period. The insights we have gained from the 2022/23 drought has been used to inform this revised dWRMP as summarised below:

Theme	What we have learnt	The impacts on WRMP
Resilience of our supply system	The impacts of the drought on our larger strategic reservoirs, Colliford and Roadford, has highlighted the need to break the multi-season impact of drought events where possible. We can achieve this through creating the headroom in our Restormel abstraction licence afforded by Blackpool Quarry and desalination and allowing greater winter pump-storage to Colliford. In Roadford, we have implemented the River Lyd scheme and planning for Gatherley Phase 1 in 2023-24 allowing for more winter pump storage.	We have included these schemes within our WRMP24 baseline. In Colliford WRZ our main constraint on deployable output is water treatment works capacity at Restormel and not linked to water availability in drought. Similarly, in Roadford the extra water provided by Lyd and Gatherley Phase 1 provides resource benefit in Roadford which we can then utilise across our WRZ through the development of internal transfers and mains upgrades.
Consider whether any new temporary schemes implemented during the drought could be made permanent	We have a number of schemes used as drought permits in 2022 which are currently being developed as licences during AMP7 to meet the immediate need of our water resource position in Colliford WRZ. These include Stannon, Hawks Tor and Porth Rialton.	These schemes are included in our baseline position from 2025. These schemes provide a resilience benefit to the Colliford WRZ. Porth Rialton, in particular, helps to manage the seasonal peaks in demand we can experience in some areas due to tourism.
Benefits of drought interventions (such as drought permits/orders and Temporary Use Bans)	We have reviewed our drought permits considered in our WRMP24 against those that were used and/ or considered during the drought of 2022/23. The main update is that the River Lyd is now a permanent scheme delivered in AMP7. The drought permit version of this scheme is now considered as an extension to run the scheme in April and May. We have reviewed the benefits that we have assumed from TUBs based on our learnings from drought 2022/23. We have calculated the benefit in demand savings for Colliford to be around 4%. Given the high level of uncertainty in determining this estimate we have not updated our assumption from 5%.	The permanent addition of the River Lyd to our baseline position provides a WAFU benefit of around 2 Ml/d. The permit for April to May has been included in the WRMP24 but is assessed to have 0 Ml/d benefit in WAFU albeit in practice it provides an enhanced level of resilience in winter storage recovery.

Theme	What we have learnt	The impacts on WRMP
Levels of service	We have reviewed our planned level of service in light of the drought of 2022. Whilst we recognise our supply-demand balance position does not reflect what we forecast in WRMP19, we have not changed our Levels of Service at this stage. We instead are developing schemes in AMP7 which ensure we maintain our committed levels of service to our customers.	No changes to Levels of Service. We include the AMP7 schemes in our baseline and demonstrate how we meet our existing Levels of Service.
Assumptions for dead storage and emergency storage are accurate	We have reviewed our emergency storage and dead storage assumptions outlined in Appendix 1.	No change or impact.
Water efficiency	We have initiated a wider range of water efficiency activities for our household and non-household as part of increased demand management to preserve resources.	These activities are continuing towards 2050 as BAU water efficiency for the company. This is described in the demand section above.
Demand baseline	The water efficiency activities we began in 2020 and will be continuing will be an important part of our future demand management.	The benefits from these BAU water efficiency activities have been included in our demand baseline forecast, Appendix 2.
Demand scenario testing	Our 2022 demand was above our WRMP19 forecasts. To ensure our plan is robust to future changes in demand we have developed some additional increased demand scenarios for our decision-making process.	In our planning approach and methodology technical appendix 6 we describe how these new scenarios have been used to test our best value plan.
Commercial Demand	We need to better understand how our business customers are affected by drought weather.	As part of preparing to deliver our WRMP24 non household water efficiency activities we will be engaging with our commercial customers to understand how we could collaborate with them to reduce their demand and make them more resilient to future drought conditions.
Drought planning and preparedness	Drought & Resilience Governance Framework: We have enhanced the management and governance framework outlined in our Drought Plan. Through our optimised framework	We have reviewed our source assumptions following the drought of 2022/23 to reflect our experiences and lessons learned.

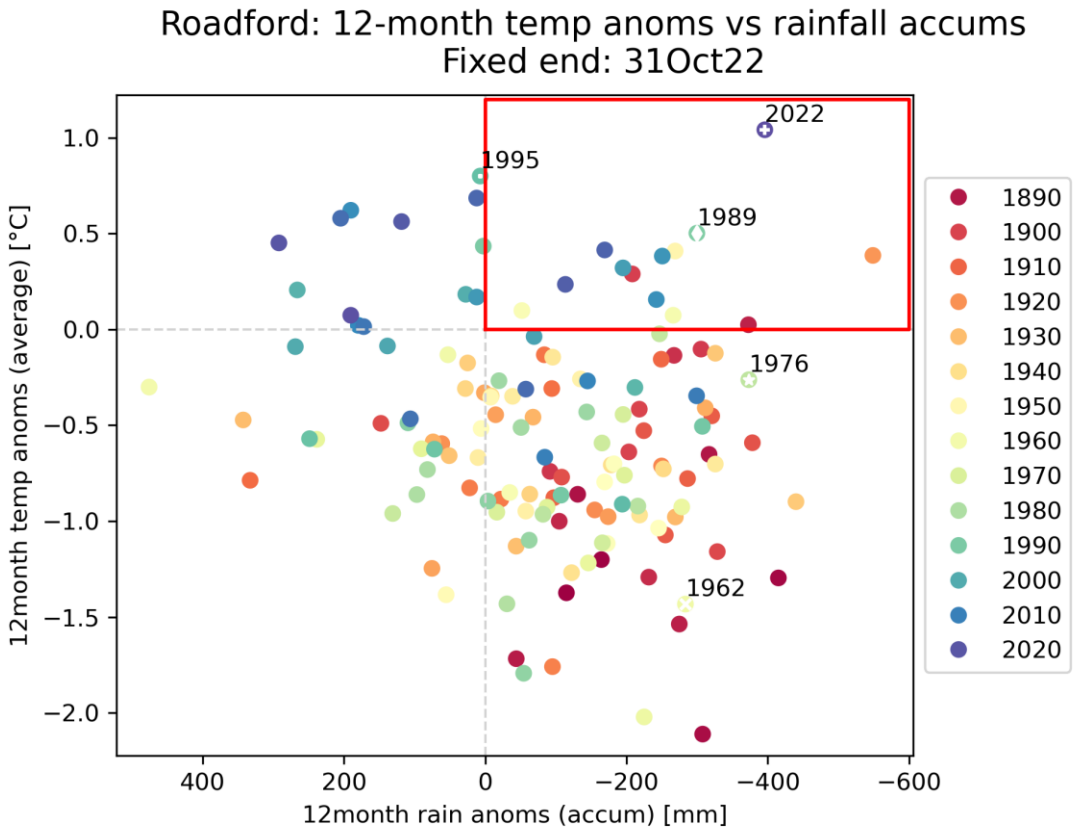
Theme	What we have learnt	The impacts on WRMP
	we have further ensured decision making processes relating to drought and resilience actions are expedited. Demand campaigns: Customer research has been undertaken to obtain customer views on our messaging relating to Temporary Use Bans and water efficiency campaigns. The research has informed our strategy relating our messaging which has proved to have strong acceptability in these areas. Drought Permit Readiness: In preparing drought permits in 2022/23 Environmental Assessment Reports and drought permits must be reviewed and updated annually to ensure we are 'permit ready'. We are working collaboratively with the Environment Agency, using their enhanced pre-application process to review permit applications (to be used only in the event of an exceptional shortage of rainfall). Emergency Planning: We have developed our Emergency Planning Scenarios. This has included working with Defra, our regulators and Local Resilience Forums to develop detailed plans for severe drought levels. Including agreeing data sharing and actions to be taken relating to vulnerable customers in the event of an incident being prepared. We have proactively shared these plans with Defra and the Environment Agency. Drought Plan review and update: As our region moves from drought to recovery status we have committed to review and update our Drought Plan for the South West Water area. From the lessons learnt during this drought we will update our drought and demand triggers and further ensure our thresholds and sequencing of actions able to respond to the increasing impacts of climate change.	In particular we have reviewed our drought permits and updated both the permits we assume and their benefits.

Theme	What we have learnt	The impacts on WRMP
Collaboration and Communication	Code of practice on water restrictions: We have worked with Water UK and the National Drought Group Water Sub Group to inform the update and improvement of the Code of Practice linked to water restrictions. We have particularly informed sections relating to Household and Non-household customers and classification of Hot Tubs in this respect. Stakeholder engagement: Understanding the importance of a shared narrative which encourages us to all play our part in securing our precious water resources we have included water resources in our regular stakeholder engagement sessions. This provides the opportunity to amplify messages encouraging behavioural changes we need to reduce consumption and progress planned interventions. Shared learning and best practice: Through the National Drought Group Water Subgroup we have shared best practice across the industry, including lessons learnt on communication plans and methods, smart metering, and drought permit applications. In addition, we have been proactive in undertaking a number of peer reviews. We have asked other companies to review the drought actions we have taken asking for challenge and comment on our plan.	
Improved coordination, consistency of communications, building on previous work, good practice and innovation.	Developing a common narrative: Through the drought we have seen the benefit of working closely across the sector and with our regulators to align messaging which provides consumers with a consistent narrative. With this in mind we have worked with communications teams in the industry, Environment Agency and CCWater; sharing best practice and lessons learnt from our research on communications.	We have worked closely with the EA during the drought 2022/23 and forged excellent relationships with our local area colleagues. We have built upon these relationships and our shared understanding as part of our engagement with the EA in developing our revised dWRMP24.

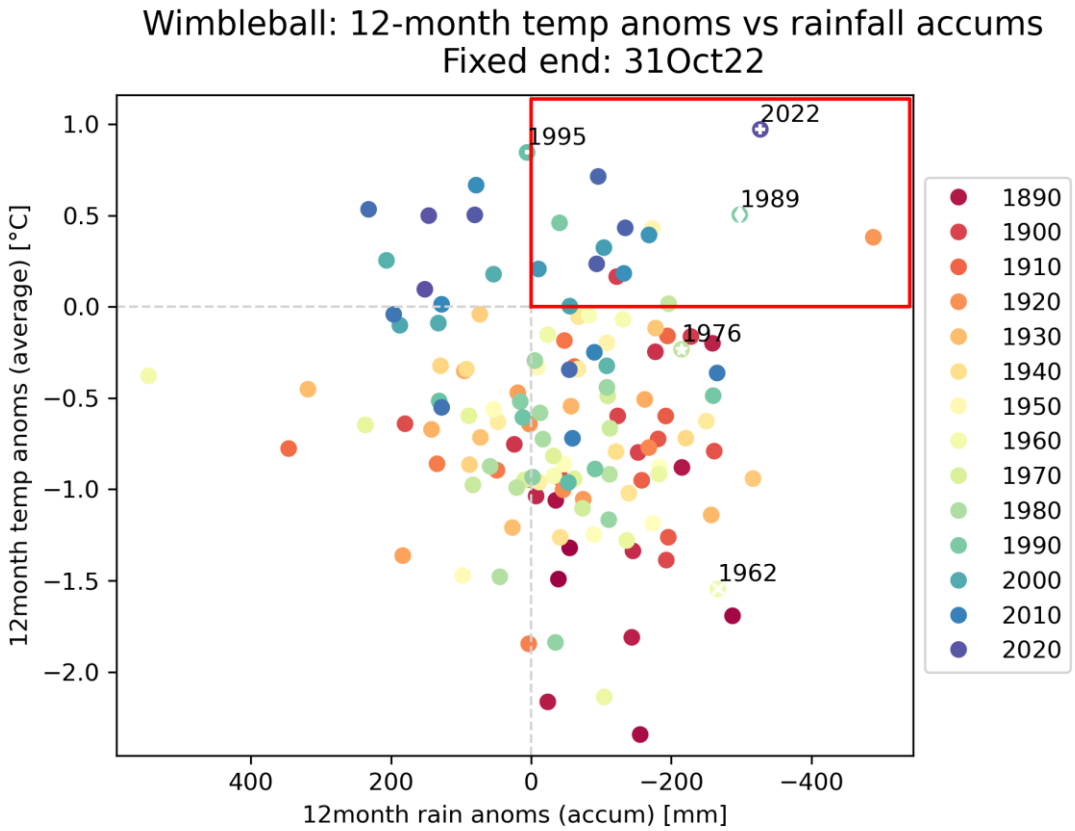
Theme	What we have learnt	The impacts on WRMP
Explore how to better share data and information.	Sharing information and data: to aid collaborative working we have regularly shared detailed water resource projections and forecast and project updates on planned interventions with our regulators (Defra, Environment Agency, DWi and Ofwat). We have also held briefings with CCWater and Natural England and other key stakeholders. Emergency planning: Through the development of our detailed plans, we have established vulnerable customer data sharing processes.	

Annex A: Combined Temperature and Rainfall Analysis for other Water Resource Zones

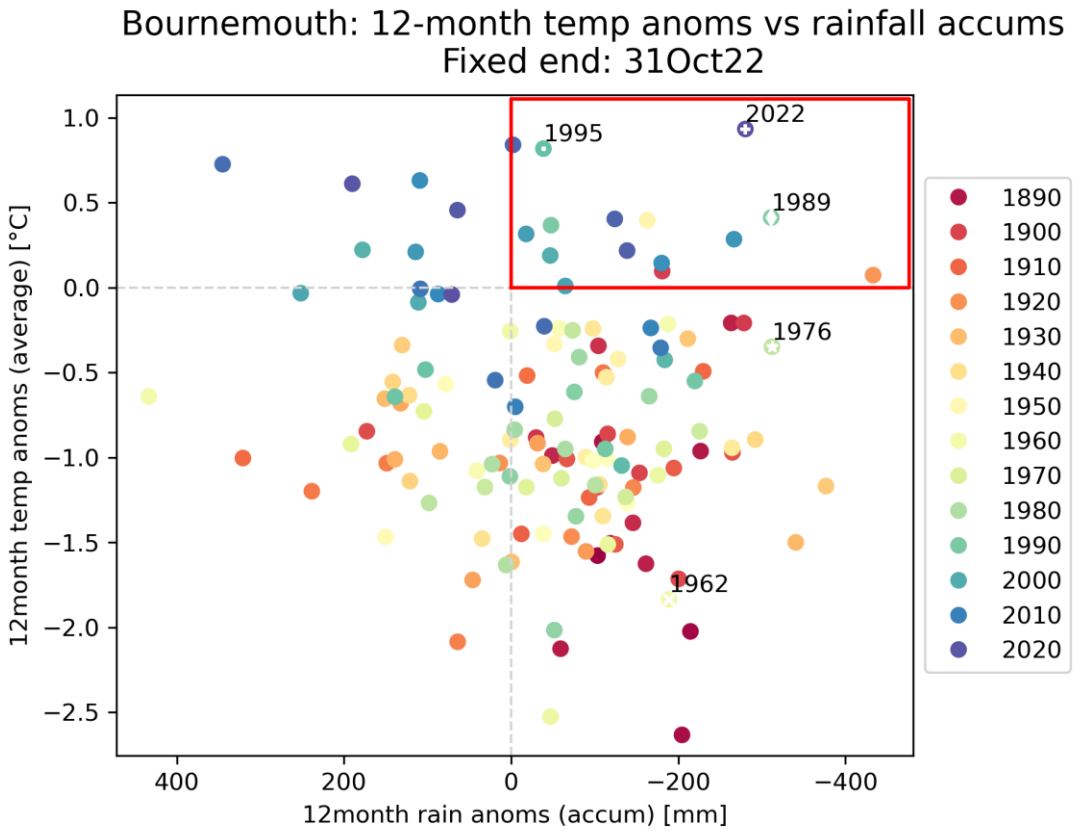
Roadford WRZ



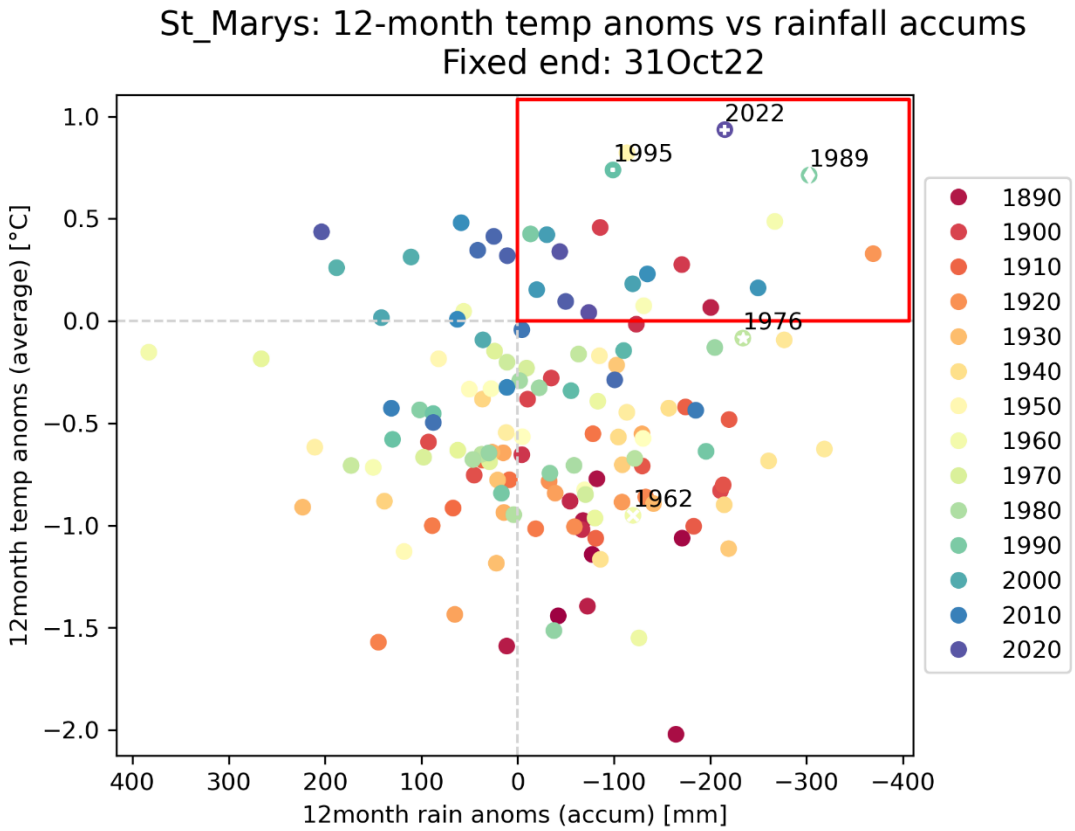
Wimbleball WRZ



Bournemouth WRZ



Isles of Scilly WRZ



South West Water

Bournemouth Water

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