Dove Drought Permit Application November 2022

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1. Introduction

This is an application by Severn Trent to the Environment Agency for a Drought Permit under s.79A of the Water Resources Act 1991. The permit relates to abstraction licences 03/28/36/148 (Foremark) and 03/28/36/147 (Staunton Harold). Licence 03/28/35/0005 (River Dove) would also be impacted, however, the part of the River Dove licence that will be changed is only for direct public water supply, it is a clause that is not normal operation so will not change actual abstraction from the River.

Severn Trent is one of the largest of the 11 regulated water and wastewater companies in England and Wales, covering the Heart of England from the Bristol Channel to the Humber and from Shropshire to the East Midlands. We serve 4.6 million homes and businesses.

We are a leading water and waste company, committed to delivering high quality services to our customers, both today and in the future.

The environment we live and work in is central to everything we do. We take our name from the two main rivers, the Severn, and the Trent, which run through our region - two of the biggest rivers in the UK. To us, the health of rivers represents the health of the whole landscape and the communities that they exist alongside. From abstracting raw water and providing clean drinking water to our customers, to safely returning treated wastewater, everything we do is intrinsically linked to rivers and other water bodies in our region. We work hard to play our part in protecting them, working with others to protect and improve their catchments.

For further information about our business, please visit www.stwater.co.uk.

The Dove reservoir system, located in southern Derbyshire, comprises two impounding reservoirs, Foremark and Staunton Harold. These reservoirs are filled using water abstracted from the River Dove. We abstract water from the Dove reservoirs to supply parts of Leicestershire and onwards into our regional Strategic Grid.

The spring and summer of 2022 have been exceptionally dry with unprecedented high temperatures over the course of the summer. As a result, inflows to some of our Strategic Grid Reservoirs have been lower than normal impacting water levels. We are therefore focussing our attention on how we can responsibly refill our reservoirs ahead of next spring/summer. This is important so that we can secure our customers' water supplies throughout 2023.

Since April our Drought Action Team has been monitoring the situation and has directed an enormous amount of activity to protect raw water supplies in the Derwent, Charnwood and other reservoirs in our Strategic Grid Water Resource Zone. Many of these actions form part of our statutory Drought Plan, which we publicly consulted on last year when we updated our 2022-2027 plan. Section 3 of this document sets out our action management plan in addition to this permit. A copy of our Drought Plan can be found on our website at https://www.severntrent.com/about-us/our-plans/.

Whilst we have carried out these proactive steps, to protect security of supply to our customers in 2023 we are applying for a Drought Permit at the Dove reservoirs to increase abstraction from the reservoirs.

A drought permit is a drought management power that, if granted, can allow more flexibility to manage water resources and the effects of drought on public water supply and the environment. The Water Resources Act 1991, as amended by the Environment Act 1995 and the Water Act 2003 empowers the Environment Agency to grant a drought permit on condition of the following criteria:

- a serious deficiency of supplies of water in any area exists or is threatened; and that
- The reason for the deficiency is an exceptional shortage of rain.

The scope of this permit and the potential effects on the Dove Reservoirs are described in our statutory Drought Plan which was published earlier this year. The evidence to support our application for a Drought Permit is set out in this Justification of Need document. This document sets out:

- How the permit would work and our assessment of environmental impacts.
- Details on the exceptionally low rainfall we have experienced this year.
- Operational measures we have undertaken including our leakage activities.
- How we have engaged our customers and are trialling new methods of reducing demand.

We have also produced a separate Environmental Assessment Report which describes the likely environmental impacts of making the required abstraction changes and explains how we will monitor and mitigate for these effects throughout the duration of the permit being in place.

Applying for a Drought Permit at the Dove Reservoirs is an unusual event, and it reflects the exceptionally low rainfall we have experienced this year.

The Drought Permit would allow us to increase the amount of water we abstract combined from Staunton Harold and Foremark from 73,200 million litres per year to 76,700 million litres per year.

We believe our customers can help us to reduce demand, but we need to do more in some areas across our region. To make sure we have enough water across winter and spring, we believe the best time to increase abstraction from the reservoirs is during the winter months when the risk of environmental impacts is minimised.

2. The Drought Permit

The terms of the drought permit being sought are as follows:

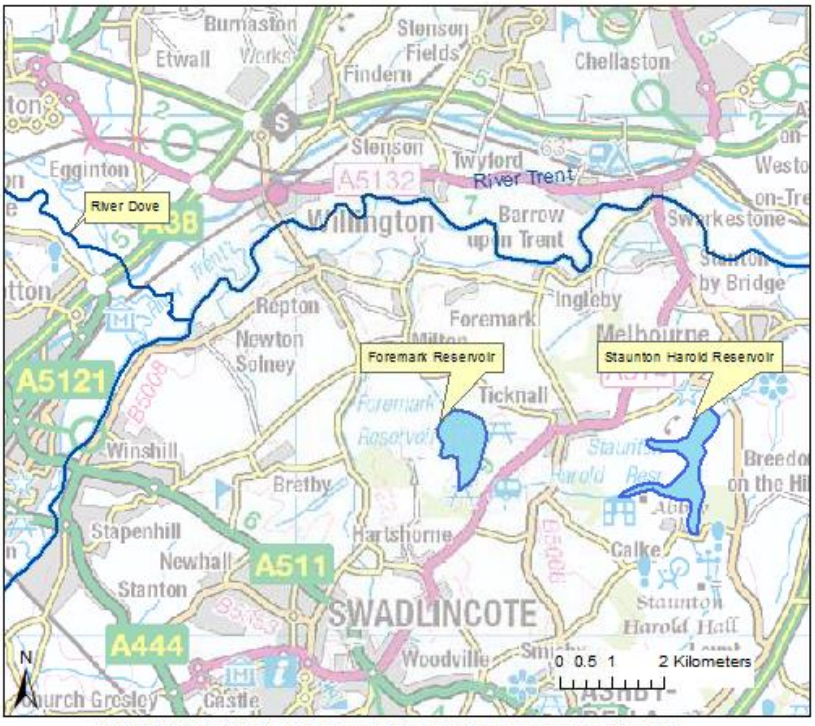
- Amend licences 03/28/36/148 and 03/28/36/147 and licence 03/28/35/0005 as referenced under the River Dove Water Board Orders 1955 – 1972 to:
    - Increase the annual aggregate abstraction from 73,200 Ml to 76,700 Ml for the period 1st April 2022 to 31st March 2023.

We are committed to undertake no increased pumping from the River Dove abstraction under the lower 90Ml/d Hands Off Flow (HOF) condition due to this permit, therefore will not use this lower HOF until the reservoir storage has returned above long-term average.

A copy of the draft permit we are requesting is included within the appendix. The final permit content is still to be finalised with the EA who may decide to include further conditions in the permit.

Our application is for the permit to come into force on 12th December and to remain in place until 31st March. We are predicted to only go above our current annual limit of 73,200Ml around the 18th March 2023 so the effect will only be during March 2023.

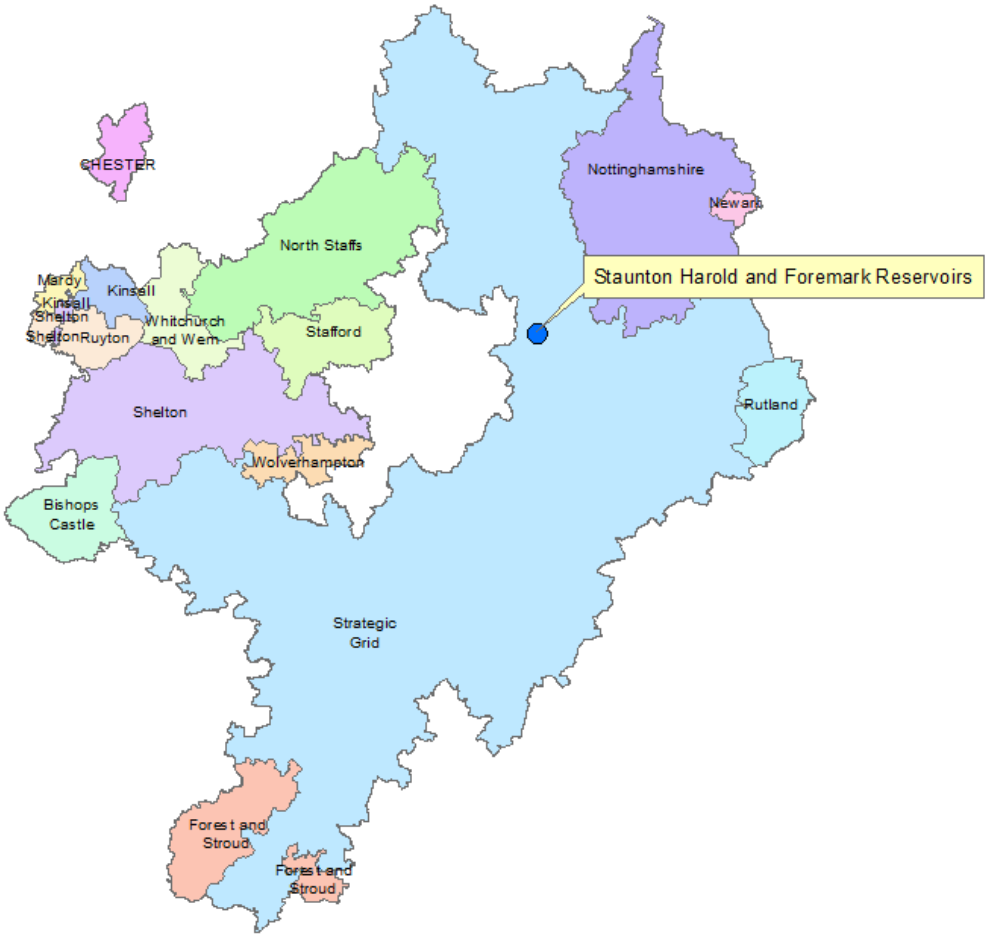
Figure 1 (Map showing the Abstraction Points)



3. Justification of Need

The Dove reservoirs form part of a wider network of strategic reservoirs, river abstractions and groundwater sources that supply our Strategic Grid Water Resource Zone. The Strategic Grid is the largest of our 15 water resource zones, and it serves over 5.5m people with drinking water supplies. Figure 2 (Severn Trent's Water Resource Zones) illustrates the extent of the Strategic Grid Water Resource Zone relative to our other zones.

Figure 2 (Severn Trent's Water Resource Zones)



3.1. The hot and dry weather of 2022 means that storage at several of our reservoirs are below normal.

The exceptionally hot and dry summer of 2022 preceded by a particularly dry spring, means that water levels in a number of our reservoirs are lower than we would normally expect for this time of year. Across the Severn Trent region the period March to August 2022 was one of the driest on record, and we have experienced below average rainfall in every one of the seven months to September.

Our Drought Action Team has been meeting weekly since April 2022 to manage the water storage risks and to take proactive steps to ensure security of supplies and the water environment are protected. Despite our proactive actions, the dry weather has particularly affected those sources situated in Derbyshire and Leicestershire and we are now having to take further steps over the coming autumn/winter to ensure our water resources are sufficiently recovered in time for spring 2023.

Figure 3 (Water availability status as of September 2022) illustrates the water availability status of our reservoir sources as in September 2022 and illustrates the water resources risk at our key reservoirs using a 'red / amber / green' status indicator. If reservoir storage is shown as 'green' then this is within the normal range for the time of year, but if it is shown as 'red' then storage has crossed one or more of our drought indicators.

Figure 3 (Water availability status as of September 2022)

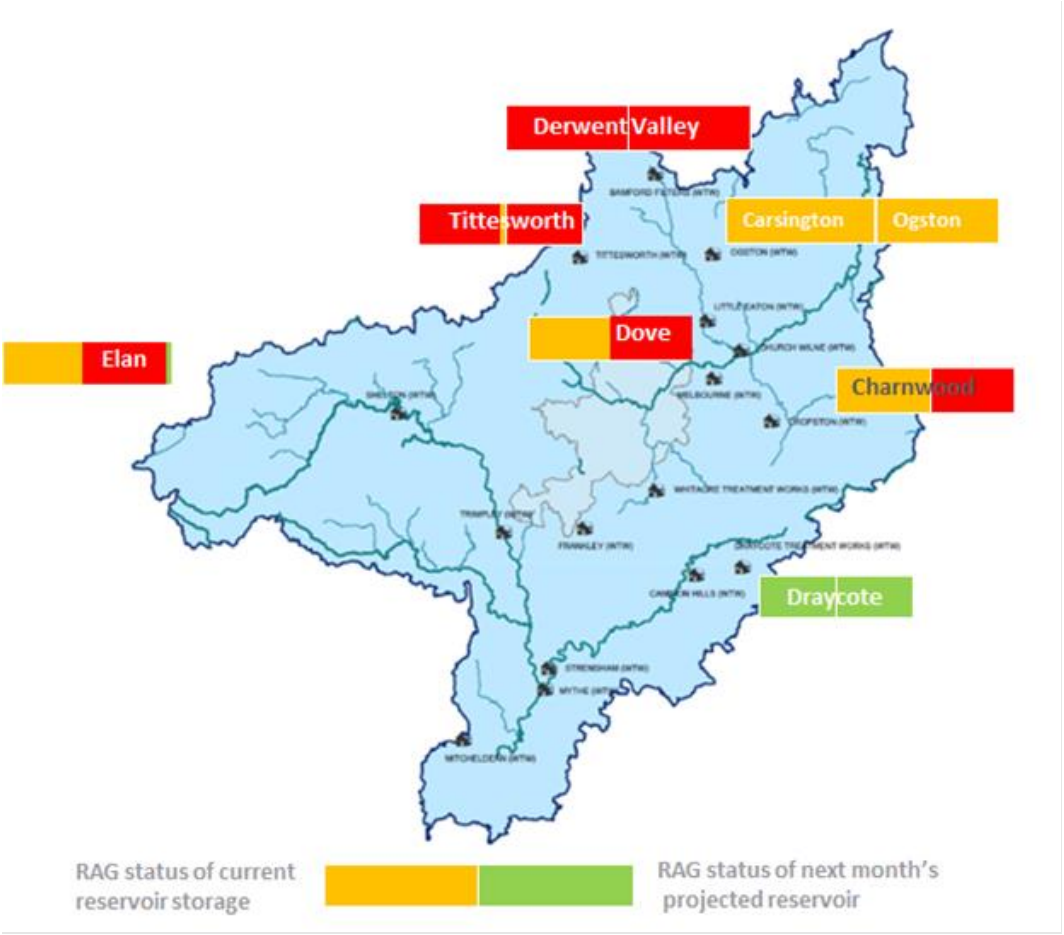
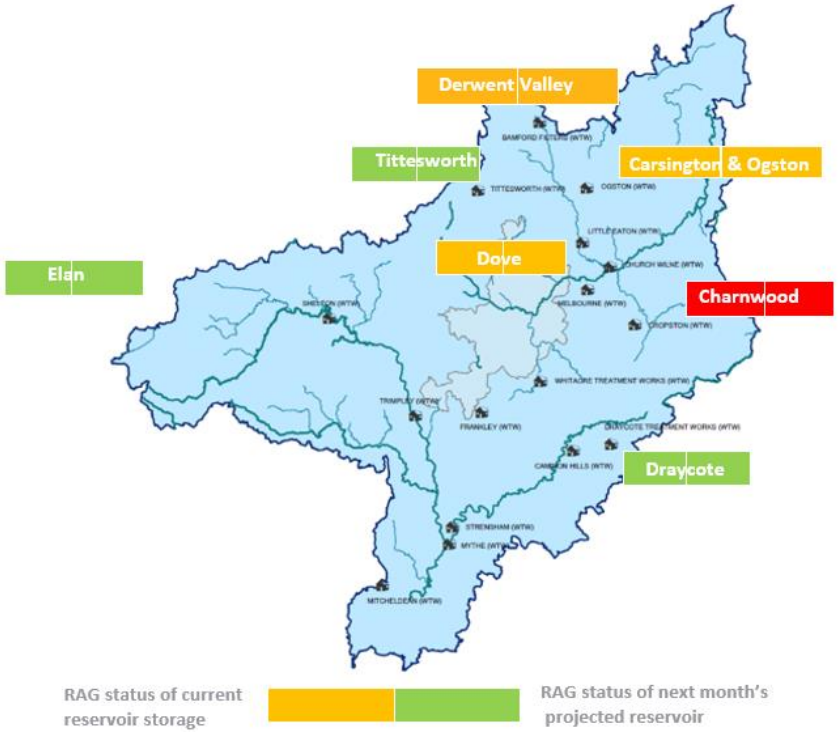


Figure 3 (Water availability status as of September 2022) illustrates the water availability status of our reservoir sources as in November 2022, which shows an improving picture due above average rainfall in October and November, but still shows we are at red status in our Charnwood reservoirs and Amber at our Derwent Reservoirs.

Figure 4 (Water availability status as of November 2022)



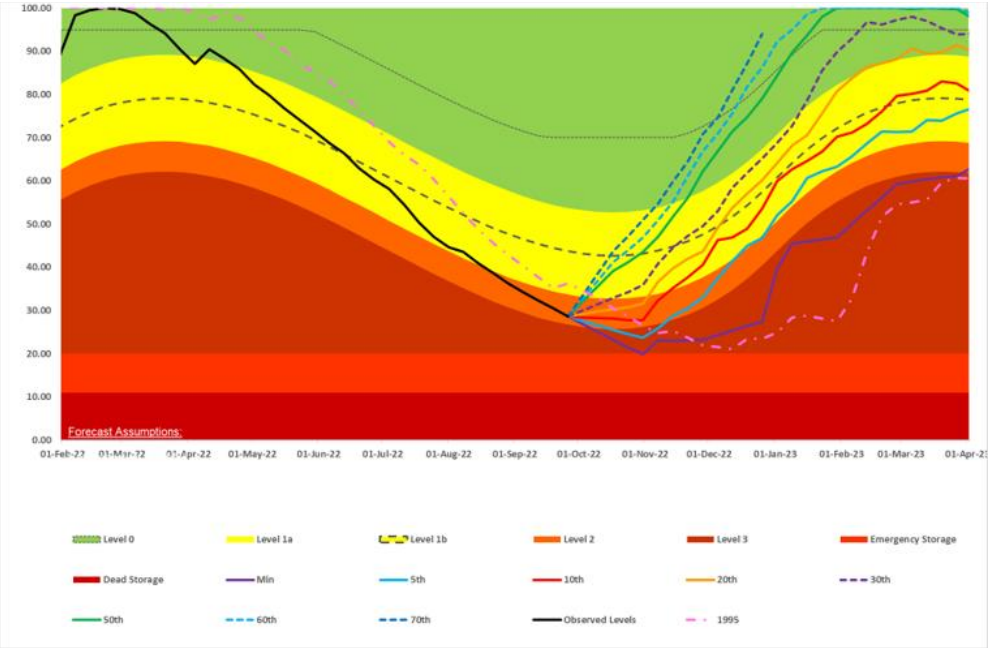
The Dove reservoir sources operate in conjunction with the other water sources in our strategic grid. The strategic grid and the ability to operate sources in conjunction gives us great flexibility to manage risks to customers' supplies. However, it also means that the operation of our different assets and sources can be affected by risks and issues that occur many miles away, and not just locally. For example, the proactive drought management actions we are having to take at our Charnwood reservoirs and Derwent Valley Reservoirs then have consequences for how we operate our Dove reservoirs sources.

It is likely we will continue to need to use higher than average abstraction at our Dove Reservoirs to help the recovery of our Derwent and Charnwood reservoirs.

3.2. We need to act now to protect security of supply and the river environment for 2023.

We continuously monitor our strategic raw water storage reservoirs, and throughout the year we make storage projections based on our 100-year record of river flows. As storage changes, we follow the triggers and actions described in our Drought Plan. Throughout the spring, summer and into autumn of 2022, storage in the Derwent Valley reservoir, shown in Figure 5 (Derwent Valley reservoir projections from 26 September 2022), and Charnwood reservoirs shown in Figure 5 (Derwent Valley reservoir projections from 26 September 2022) had tracked close to the "minimum" projection which is based on the driest scenario from our record. This meant we had to reduce our abstraction from Derwent and Charnwood as much as possible. Which increased our reliance on the Dove reservoirs abstraction.

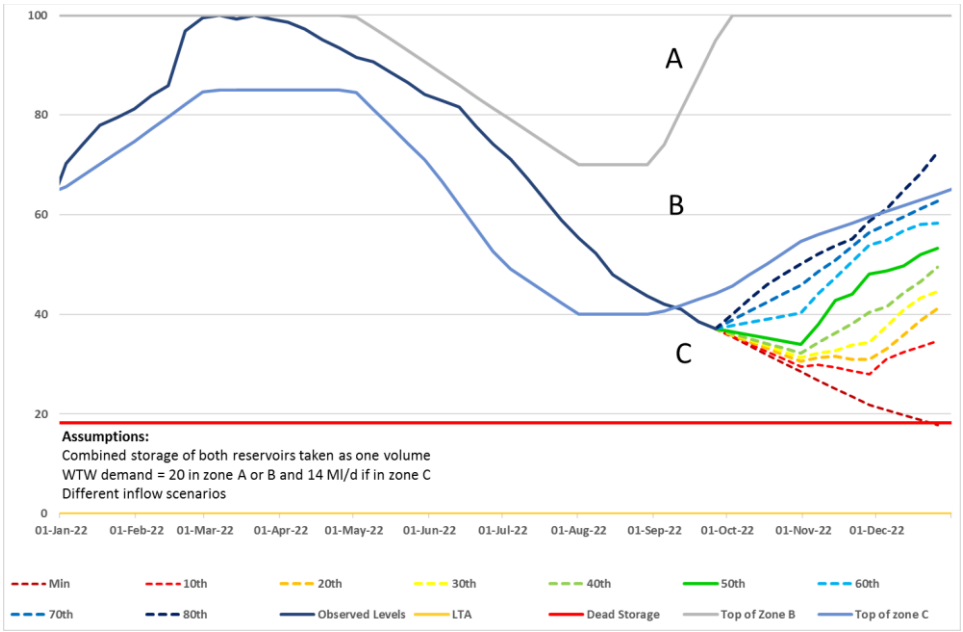
Figure 5 (Derwent Valley reservoir projections from 26 September 2022)



Between April 2022 and the end of September 2022 total storage in the Derwent Valley reservoirs was lower than we recorded in the severe drought of 1995-96, which was the last year we had to resort to a Drought Order to support those reservoirs.

On the 14th October 2022, we were granted a Drought permit at the Derwent Valley reservoirs, this was to aid the refill of these reservoirs. Part of the stipulations within this Derwent Valley Drought permit was to reduce our abstraction from those reservoirs to a 60 day rolling average of 135Ml/d for the life of the permit (Compared to average winter abstraction of around 200-240Ml/d). This was to help reduce the length of the permit. An effect of this clause is an increased reliance on abstraction from the Dove Reservoirs across winter 2022/23 whilst that permit is in place. Alongside increased use of our other sources that feed into the strategic grid.

Figure 6 (Charnwood reservoir projections from 26 September 2022)

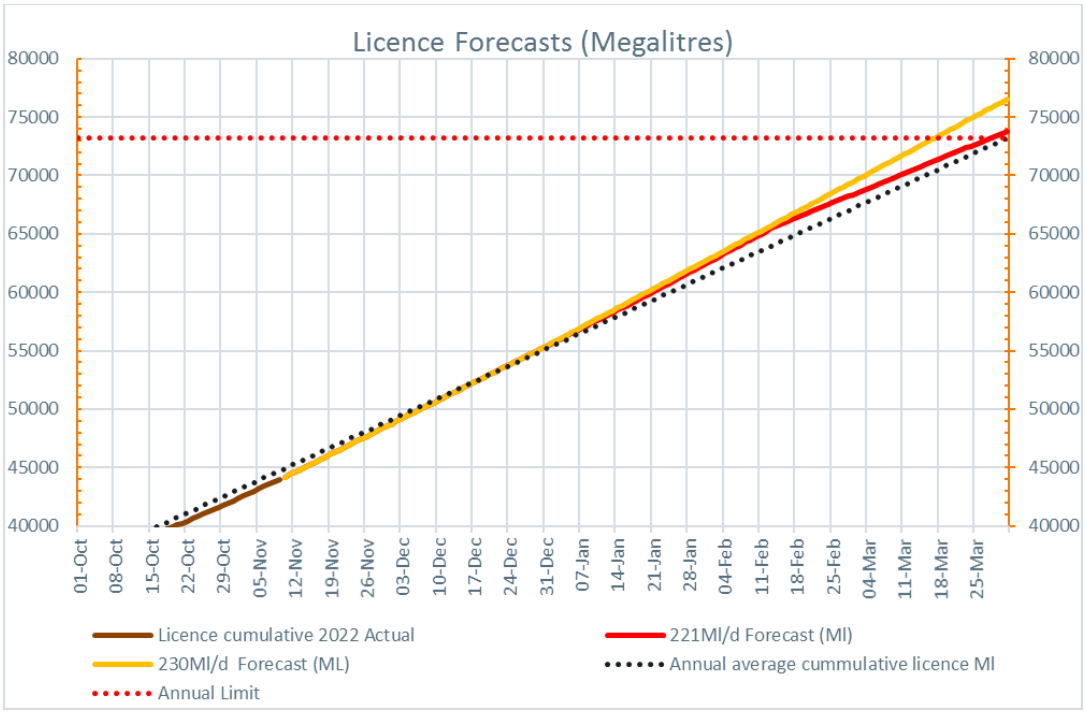


Throughout the very hot dry summer of 2022 we managed our levels in the Charnwood reservoir within zone B or above of our licence zones, however the continued dry weather in August and September dropped us into zone C of our licence zones, which restricts the abstraction from the reservoir to 14Ml/d max. This has meant we have had to use more abstraction from our Dove reservoirs. Projections at Charnwood show it is unlikely to refill unless we stop abstraction for period across winter. During this time, we will need to abstract more from the Dove reservoirs to help keep our customers on supply.

In summary, the exceptional shortage of rainfall has resulted in below normal reservoir storage across a number of our Midlands sources, and in particular at our Derwent Valley reservoir and Charnwood reservoirs which has meant that we have had to and will continue to need have to abstract more water from our Dove Reservoirs. We therefore require a temporary increase on the annual abstraction licence from the Dove reservoirs to avoid a risk of a serious deficiency in supplies in our Strategic Grid Water Resource Zone.

Figure 7 below shows the predicted abstraction that we are likely to need from the Dove Reservoirs to support the recovery of the Derwent and Charnwood reservoirs across winter. As can be seen this would see us crossing our annual licence limit around the 17-18th March 2023. Therefore, without the increased abstraction licence we would be short of around 3500Ml of abstraction or up to 235ML/d between then and the end of March 2023.

Figure 7 Dove Reservoir Projected Abstraction



The purpose of the Drought Permit is to allow more abstraction from the Dove Reservoirs, which help maximise refill of the Derwent Valley reservoirs and Charnwood Reservoirs over the coming winter in order to secure customers' water supplies throughout 2023. Our customers would expect that during a drought period, as well as actively reducing demand by helping customers to use less water, and targeting leakage, that we would plan ahead and consider proactive measures as well as providing advance warning to consumers and clear communications about the impact.

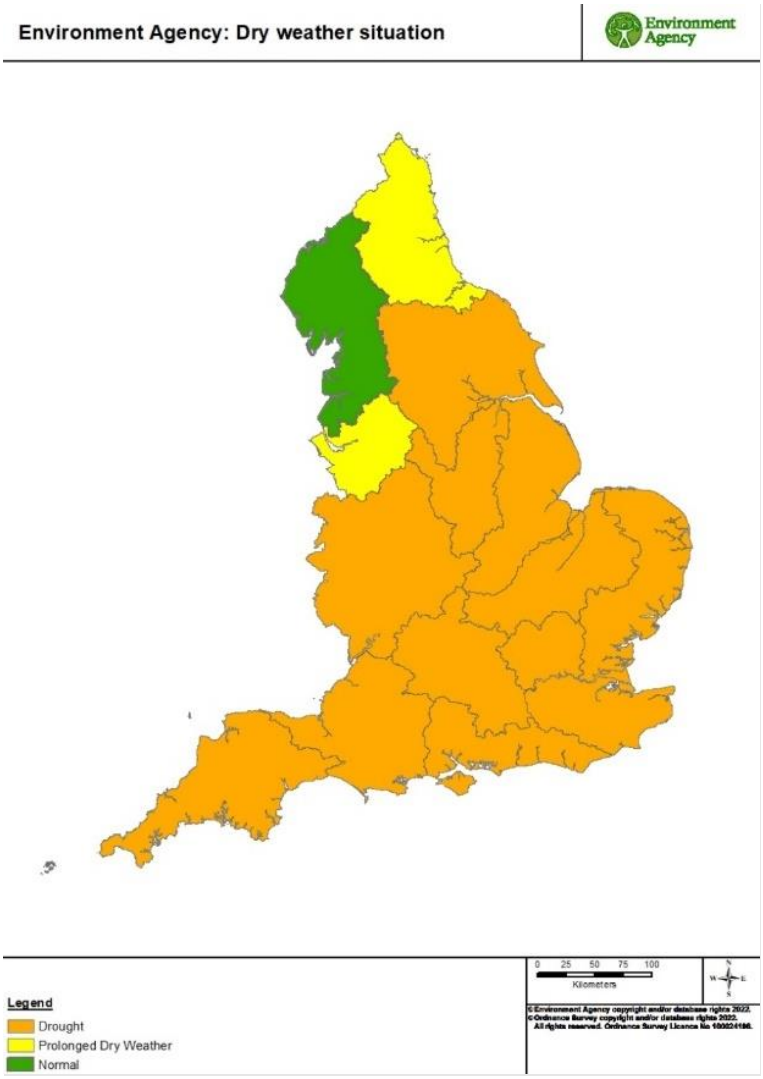
If we cannot increase the abstraction licence out of the Dove reservoirs, then customers' 2023 security of supply will be put at risk in our Strategic Grid water resource zone, as either we may not be able to fully refill our Derwent Valley and Charnwood reservoirs system, or we would have to stop abstracting from the Dove reservoirs in March, which would be over 200Ml/d loss to the system.

4. We have seen an exceptional shortage of rainfall

The spring and summer of 2022 have seen deviations from average conditions across the United Kingdom, notably:

- Six consecutive months (March – August) with below average rainfall across England. (EA, 2022);
- The driest year so far for both the UK and England since 1976, ranking 15th driest (for the UK) and 5th driest (for England) since 1836 (Met Office, 2022);
- Driest July in England since 1935 (Met Office, 2022)
- Driest summer period June-August across England since 1995 (EA, 2022);
- The first ever Red Extreme Heat warning for parts of England and an Amber Extreme heat warning, covering much of England, Wales and southern Scotland. (Met Office, 2022);
- A new U.K. record breaking temperature of 40.3C in Lincolnshire, England in July (Met Office, 2022)
- 11 out of 14 EA hydrological areas, including all of Severn Trent region at EA Drought Status (see figure below).

Figure 8 (EA Drought Status Autumn 2022)



The low rainfall affected our water supplies across both the East and West of our region over spring and summer, most notably:

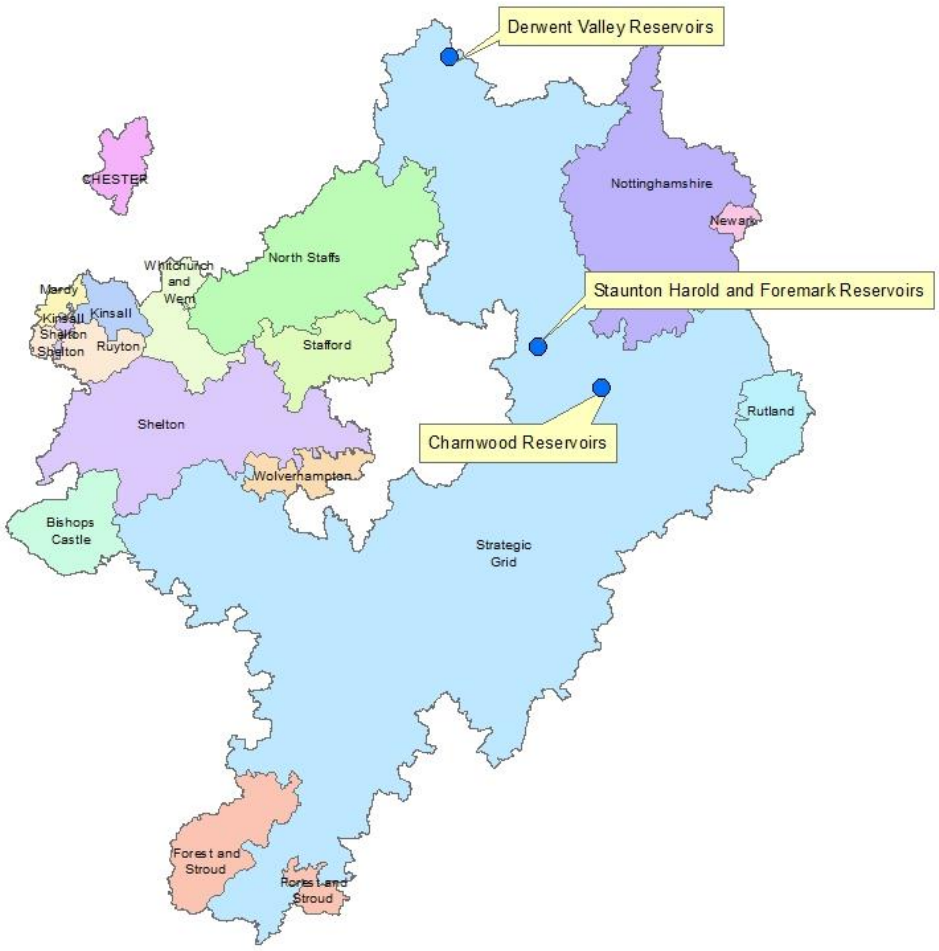
- The Derwent Valley reservoirs in the Derwent Catchment;

- The Elan Valley reservoirs in the Elan catchment in Wales.
- The Charnwood Reservoirs in our Soar Catchment
- Dove Reservoirs

We subsequently applied for a drought permit at Derwent Valley reservoirs which was granted on 14th October and will in place for up to 6 months until stocks have recovered. As of November 2022 we are seeing continued recovery of our reservoirs, but some have not yet refilled to normal levels.

The Strategic Grid is the largest of our 15 water resource zones, and it serves over 5.5m people with drinking water supplies. Whilst there has been a need to preserve and recover storage at Derwent Valley we have also had other reservoir systems that have been impacted by low rainfall within the Strategic Grid. Due to low rainfall in their catchment our Charnwood reservoirs in Leicestershire continue to be lower than expected for the time of year, this combined with Derwent Valley levels has meant an increased reliance on our Dove reservoirs (Staunton Harold & Foremark) for supply within our Strategic Grid, despite decreased inflow at these reservoirs as well.

Figure 9 (Locations of the Derwent Valley, Dove and Charnwood reservoirs)

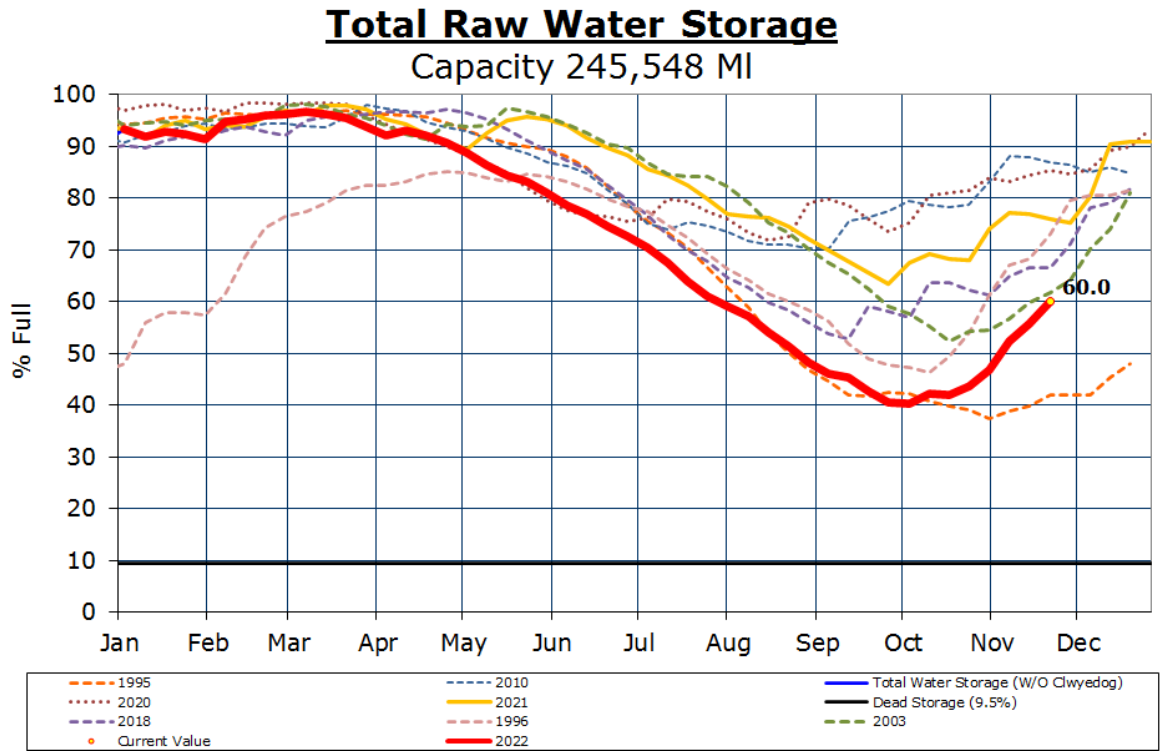


4.1. Overview of supply situation and hydrological context

Across the Severn Trent region lower than average rainfall has been experience each month throughout Spring and Summer 2022. Prior to this, February had been extremely wet and had helped replenish levels; alongside our winter refill plan which is designed to ensure our reservoirs across the company started out the year in a strong position.

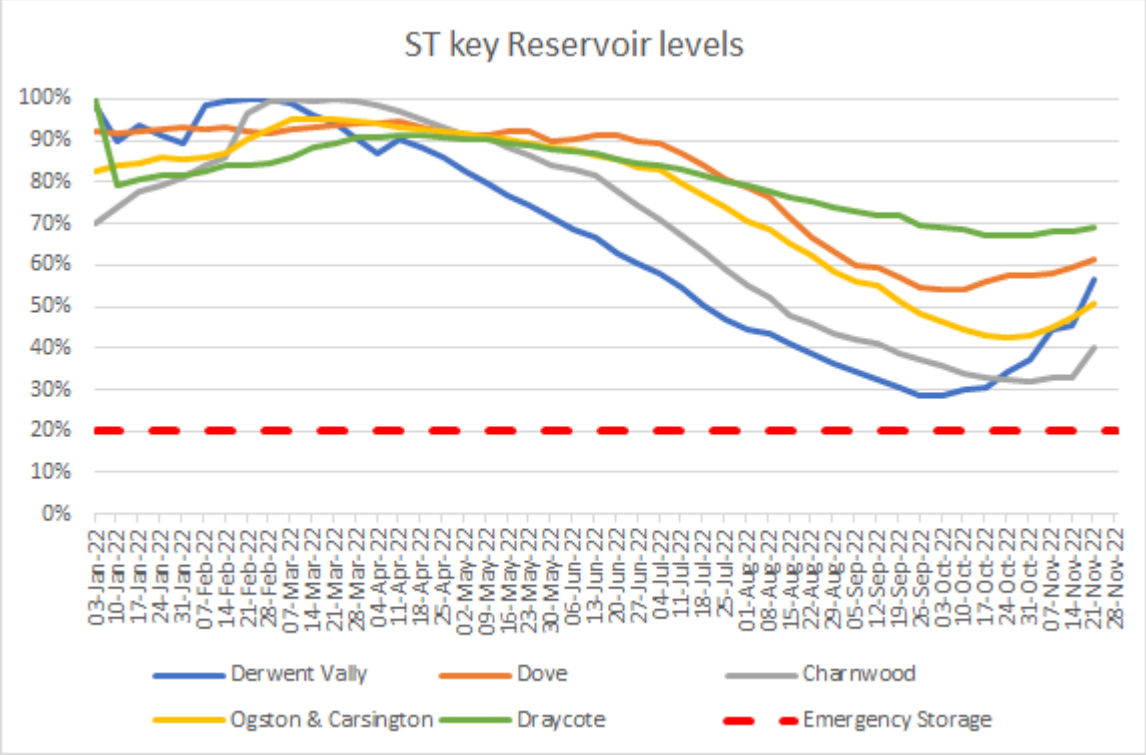
Our overall company raw water storage has dropped at a rate similar to the drought year of 1995 throughout the Spring and Summer 2022. Since mid-October however, reservoir stocks have started to recover as can be seen in Figure 10 (Company Storage for 2022 and other dry years This recovery is more in line with that seen in the 2018 drought year. As of the 21st November 2022 total company raw water stock are at 60% which is still very low for the time of year.

Figure 10 (Company Storage for 2022 and other dry years as at 21st Nov 2022)



As a consequence of exceptionally low rainfall across our Severn Trent region during the summer of 2022, the continued below average rainfall and associated low soil moisture deficits during the Summer and early Autumn, storage in a number of our other strategic reservoirs are below or well below the expected levels for this time of year which is shown below in Figure 11. The wetter weather experience since mid-October 2022 has started to see a recovery (or levelling in some case) in levels.

Figure 11 (Raw water availability status as of 21th of November 2022)



Overall, our Strategic Grid water resource zone has seen exceptionally low rainfall over the drawdown period for 2022. Table 1 has used the Cunnane (1978) 1 plotting position which calculates the probability of one of the ranked values being lower than expected and categorises rainfall data into descriptive categories. This shows the single and cumulative months results for the Strategic Grid water resource zone. The single 1-month rainfall for April and August are classified as 'NL' (Notably Low) and 'EL' (Exceptionally Low) for July. When looking at cumulative values the categorisation shows 'EL' (Exceptionally Low) from July to September in at least one month from months of cumulative rainfall 2-6.

Table 1 (Strategic Grid catchment rainfall probabilistic ranking using Cunnane (1978) Banding)

Period (Months) of Cumulative Rainfall	Period Ending in Month											
	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22
1	102.5	31.2	82.2	25.1	99.8	39.8	20.8	49.0	46.0	18.8	34.0	56.5
	AN	EL	N	NL	NH	N	NL	N	N	EL	NL	N
	169%	48%	113%	38%	195%	68%	39%	85%	78%	35%	51%	93%
2	161.9	133.7	113.4	107.3	124.9	139.6	60.6	69.8	95.0	64.8	52.8	90.5
	AN	N	BN	BN	N	AN	NL	BN	N	NL	EL	BN
	133%	106%	82%	77%	106%	127%	54%	62%	81%	58%	44%	71%
3	198.8	193.1	215.9	138.5	207.1	164.7	160.4	109.6	115.8	113.8	98.8	109.3
	N	N	N	NL	N	N	N	NL	BN	NL	EL	NL
	106%	103%	109%	68%	109%	94%	98%	65%	68%	67%	55%	60%
4	273.7	230.0	275.3	241.0	238.3	246.9	185.5	209.4	155.6	134.6	147.8	155.3
	N	N	N	BN	N	N	BN	N	BN	EL	NL	NL
	113%	91%	106%	91%	93%	99%	81%	95%	68%	60%	62%	65%
5	309.2	304.9	312.2	300.4	340.8	278.1	267.7	234.5	255.4	174.4	168.6	204.3
	N	N	N	N	N	N	N	BN	N	NL	EL	NL
	103%	99%	96%	92%	108%	89%	89%	82%	91%	62%	58%	69%
6	426.2	340.4	387.1	337.3	400.2	380.6	298.9	316.7	280.5	274.2	208.4	225.1
	AN	BN	N	BN	N	N	BN	N	BN	BN	EL	EL
	119%	93%	102%	86%	106%	102%	81%	88%	81%	82%	60%	64%
7	438.3	457.4	422.6	412.2	437.1	440.0	401.4	347.9	362.7	299.3	308.2	264.9
	N	N	N	BN	N	N	N	BN	N	NL	BN	NL
	106%	108%	96%	92%	98%	101%	94%	82%	87%	75%	77%	65%
8	475.7	469.5	539.6	447.7	512.0	476.9	460.8	450.4	393.9	381.5	333.3	364.7
	N	N	N	BN	N	N	N	N	BN	BN	NL	BN
	101%	98%	109%	89%	103%	95%	94%	93%	81%	81%	71%	79%
9	531.2	506.9	551.7	564.7	547.5	551.8	497.7	509.8	496.4	412.7	415.5	389.8
	N	N	N	N	N	N	BN	N	N	NL	NL	NL
	102%	95%	100%	100%	98%	99%	90%	93%	91%	77%	77%	74%

The follow sections outline the evidence for exceptional shortage of rainfall (ESOR) in three key catchments. Dove, Upper Derwent, and Charnwood (Soar catchment). This is because though the permit being applied for is in the Dove Catchment, the reason for needing the permit is the wider ranging exceptional shortage of rainfall

across our Strategic Grid water resource zone, and specifically the ESOR in Upper Derwent and Charnwood. This is because the permit is to allow us to abstract more water from the Dove Reservoirs, to support reduced abstraction at these other reservoirs, where the ESOR has meant the reservoirs have been drawn down to very low levels.

4.2. There has been a prolonged period of exceptionally low rainfall in the Dove catchment

Foremark and Staunton Harold reservoirs, the Dove reservoirs, are located in the River Dove catchment. We operate these reservoirs in conjunction with our other sources of water in the Midlands to supply our Strategic Grid water resource zone.

We have used Environment Agency daily rainfall tool (DRT) data for the Dove Midlands catchment. Please note for November data from the 24th to the 30th we have used forecasted data.

Actual monthly rainfall totals for the Dove catchment are shown in Table 2 (2022 Monthly rainfall (in mm) Dove catchment [based on HADUK DRT data, with Figure 12 showing the monthly rainfall totals as a percentage of Long-Term Average (LTA) (based on the Met Office standard LTA period of 1961-1990) for the Severn Trent region and the Dove catchment.

Table 2 (2022 Monthly rainfall (in mm) Dove catchment [based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)

Month	Total rainfall (mm)	LTA (1961-90)	Percentage of long term average (%)	Percentage of 3-month long term average (%)	Percentage of 6-month long term average (%)	Percentage of 7-month long term average (%)
Jan	41.3	90.0	46%	85%	93%	101%
Feb	150	67.3	223%	129%	113%	108%
Mar	38.4	73.3	52%	100%	108%	105%
Apr	38.1	65.8	58%	110%	96%	102%
May	60.8	67.8	90%	66%	100%	95%
Jun	44.2	70.8	62%	70%	86%	95%
Jul	39.1	64.3	61%	71%	91%	83%
Aug	28.6	77.4	37%	53%	59%	82%
Sep	83.3	75.2	111%	70%	70%	67%
Oct	134.2	81.2	165%	105%	89%	85%
Nov	134.85	89.8	150%	143%	101%	100%

Figure 12 (Actual rainfall as percentage of Long-Term Average (Dove Catchment) based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)

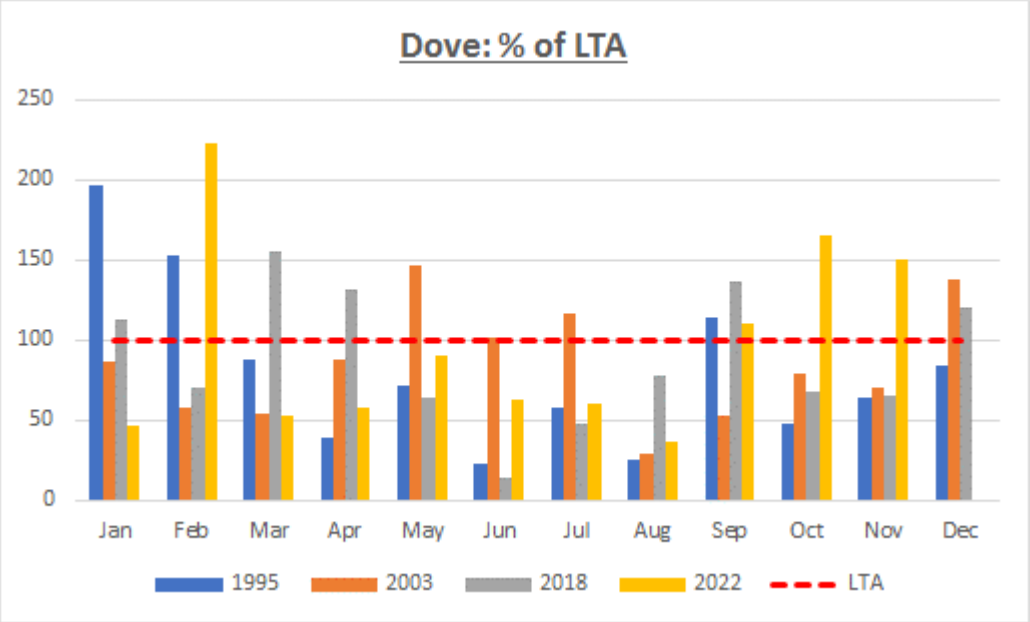
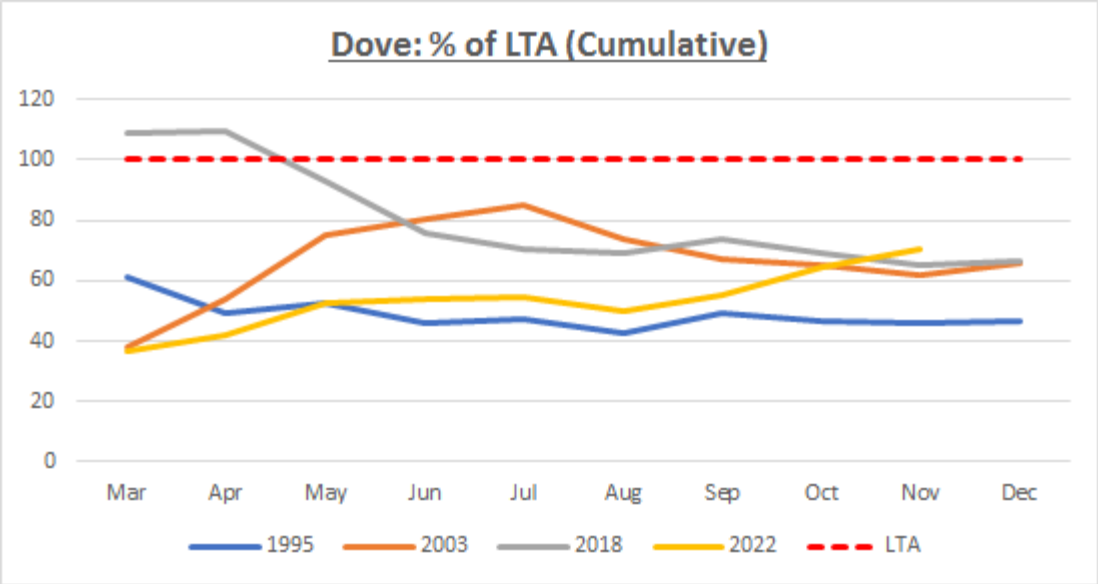


Figure 13 (Actual rainfall as percentage of cumulative Long-Term Average (Dove Catchment) based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)



Throughout winter, spring and summer 2022 the Dove catchment has received below average rainfall in every month except for February which was exceptionally high. Levels in the Dove reservoirs still managed to start April at 94% combined. Rainfall in the catchment was notably low in June, July and August at 62%, 61% and 37% of LTA respectively. The six months to August 2022 and seven months to September 2022 saw 59% and 70% of LTA rainfall respectively. A wetter than average October has improved this somewhat with the seven month LTA percentage now at 85% (to October 2022).

A comparison of rainfall as a percentage of the cumulative LTA is shown in Figure 13 (Actual rainfall as percentage of cumulative Long-Term Average (Dove Catchment) based on HADUK DRT data, illustrating that the catchment has consistently received below average rainfall since March. When compared to previous dry years it has

trended in line with 1995 figures for until October 2022 when increased rainfall has brought it more in line with the drought years of 2003 & 2018.

Table 3 (Dove catchment 1891 to 2022 Rainfall Rankings (1 = driest)) below shows the rank of each month during the period of storage drawdown at the Dove Reservoirs from January to November 2022, against the 131-year record for periods of 1 to 7 months for the whole Dove catchment. Monthly totals across July, August and September were very low.

The six months to August (5th) and seven months to September (9th) are both within the ten driest periods in the last 131 year record. As with the LTA data above a wet October has seen an improvement with the seven months to October being the 41st driest.

It can be seen that October and November have had above average rainfall, this will help with the refill of the Dove reservoirs, though due to the main inflow to the reservoirs being pumped abstraction from the River Dove this will be limited to the maximum abstraction of the pumps/licence.

Table 3 (Dove catchment 1891 to 2022 Rainfall Rankings (1 = driest))

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
1 month	16	129	34	35	67	40	24	11	92	119	119
2 month	79	115	123	25	45	44	25	4	37	116	126
3 month	58	118	93	111	29	35	25	6	19	87	126
4 month	83	110	108	75	108	21	17	11	19	61	109
5 month	83	115	100	101	76	93	13	4	21	49	98
6 month	65	114	110	89	99	63	72	5	14	52	84
7 month	87	104	107	101	89	92	42	35	9	41	80

Table 4 (Dove catchment Return period based on DRT monthly ranking (1 = normal year))

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
1 month	8	1	4	4	2	3	6	12	1	1	1
2 month	2	1	1	5	3	3	5	33	4	1	1
3 month	2	1	1	1	5	4	5	22	7	2	1
4 month	2	1	1	2	1	6	8	12	7	2	1
5 month	2	1	1	1	2	1	10	33	6	3	1
6 month	2	1	1	1	1	2	2	26	9	3	2
7 month	2	1	1	1	1	1	3	4	15	3	2

Standardised Precipitation Index

To give an indication of whether a drought is emerging it is useful to use mechanisms such as the Standardised Precipitation Index (SPI). SPI normalises rainfall based on a historic record, enabling the comparison between geographic areas and across different time periods to determine how dry it has been relative to a standard measure.

Table 5Table 3 (Dove catchment 1891 to 2022 Rainfall Rankings (1 = driest)) shows the SPI (using the Had-UK Daily Rainfall Tool data). Each column represents a month or series of months, e.g., August SPI-1 represents the individual month of August 2022, August SPI-2 represents the cumulative two months July and August, and so on. The size of the SPI denotes how wet or dry the period has been. These SPI definitions are shown in Table 6.

Over the six month period to August (SPI-6) the SPI was -2.223, meaning that the spring and summer of 2022 is categorised as 'Extremely Dry'. August's one month SPI (SPI-1) to five month SPI (SPI-5), is 'Severely Dry'.

The seven month period to September (SPI-7) had an SPI of -1.76, meaning that this period is 'Severely Dry'.

Table 5 (Dove Had-UK data & EA DRT data deriving SPI)

Month	SPI -1	SPI -2	SPI -3	SPI -4	SPI -5	SPI -6	SPI -7	SPI -8	SPI -9
Aug-22	-1.74	-1.985	-1.825	-1.744	-1.968	-2.223	-0.945	-1.421	-0.849
Sep-22	0.466	-0.718	-1.239	-1.33	-1.295	-1.532	-1.76	-0.696	-1.13

Table 6 (SPI definitions)

SPI value	SPI Category
>=2.0	Extremely wet
+1.5 to +1.99	Severely wet
+1.0 to +1.49	Moderately wet
-0.99 to + 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
<=-2.0	Extremely dry

Table 7 has used the Cunnane (1978) 1 plotting position which calculates the probability of one of the ranked values being lower than expected and categorises rainfall data into descriptive categories. This shows the single and cumulative months results for the Dove catchment. The single 1-month rainfall for August is classified as 'NL' (Notably Low). When looking at cumulative values August rainfall ranked as 'EL' (Exceptionally Low) for 2 to 6 monthly accumulations . The 7-month total for September is also ranked as 'Exceptionally Low'.

Table 7 Dove catchment rainfall probabilistic ranking using Cunnane (1978) Banding)

Station:	Dove											
Period (Months) of Cumulative Rainfall	Period Ending in Month											
	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22	Oct 22
1	61.5	129.9	41.3	150.0	38.4	38.1	60.8	44.2	39.1	28.6	83.3	134.2
	BN	AN	NL	EH	BN	BN	N	BN	BN	NL	N	AN
	68%	140%	46%	223%	52%	58%	90%	62%	61%	37%	111%	165%
2	173.3	191.4	171.2	191.3	188.4	76.5	98.9	105.0	83.3	67.7	111.9	217.5
	N	N	N	AN	NH	BN	N	N	NL	EL	BN	AN
	101%	105%	94%	122%	134%	55%	74%	76%	62%	48%	73%	139%
3	240.2	303.2	232.7	321.2	229.7	226.5	137.3	143.1	144.1	111.9	151.0	246.1
	N	AN	N	AN	N	AN	BN	BN	NL	EL	NL	N
	98%	115%	85%	129%	100%	110%	66%	70%	71%	53%	70%	105%
4	298.3	370.1	344.5	382.7	359.6	267.8	287.3	181.5	182.2	172.7	195.2	285.2
	N	N	N	N	AN	N	AN	NL	NL	EL	NL	N
	92%	109%	97%	113%	111%	90%	105%	65%	68%	62%	68%	96%
5	402.4	428.2	411.4	494.5	421.1	397.7	328.6	331.5	220.6	210.8	256.0	329.4
	N	N	N	AN	N	N	N	N	NL	EL	NL	BN
	104%	103%	96%	117%	102%	102%	90%	96%	65%	61%	72%	89%
6	425.9	532.3	469.5	561.4	532.9	459.2	458.5	372.8	370.6	249.2	294.1	390.2
	N	N	N	AN	N	N	N	N	N	EL	NL	BN
	93%	111%	93%	113%	108%	96%	100%	86%	91%	59%	70%	89%
7	568.8	555.8	573.6	619.5	599.8	571.0	520.0	502.7	411.9	399.2	332.5	428.3
	N	N	N	N	N	N	N	N	BN	BN	EL	BN
	108%	101%	101%	108%	105%	102%	95%	95%	83%	82%	67%	85%
8	584.4	698.7	597.1	723.6	657.9	637.9	631.8	564.2	541.8	440.5	482.5	466.7
	N	AN	N	AN	N	N	N	N	N	NL	BN	BN
	99%	113%	93%	113%	102%	100%	101%	91%	92%	76%	86%	81%
9	635.1	714.3	740.0	747.1	762.0	696.0	698.7	676.0	603.3	570.4	523.8	616.7
	N	N	N	N	N	N	N	N	N	BN	NL	N
	95%	104%	104%	105%	107%	98%	99%	97%	88%	85%	80%	96%
10	698.1	765.0	755.6	890.0	785.5	800.1	756.8	742.9	715.1	631.9	653.7	658.0
	N	N	N	AN	N	N	N	N	N	BN	BN	BN
	95%	101%	98%	115%	100%	103%	97%	96%	94%	83%	88%	90%
11	868.2	828.0	806.3	905.6	928.4	823.6	860.9	801.0	782.0	743.7	715.2	787.9
	N	N	N	N	AN	N	N	N	N	BN	BN	N
	106%	100%	95%	108%	109%	97%	102%	94%	93%	89%	86%	95%
12	1010.2	998.1	869.3	956.3	944.0	966.5	884.4	905.1	840.1	810.6	827.0	849.4
	AN	AN	N	N	N	N	N	N	N	BN	BN	N

4.3. There has been a prolonged period of exceptionally low rainfall in the Upper Derwent Catchment which feeds our Derwent Valley Reservoirs

We have also carried out analysis of the rainfall for the Upper Derwent catchment to understand how the rainfall this year has compared to previous years.

Table 8 below shows total rainfall with 1, 3, 6 and 7 month percentages of LTA. Since March 2022 the Upper Derwent catchment has received below average rainfall in every month with the exception of October. The lowest rainfall totals for the catchment were 40% and 49% in March and July, respectively. Rainfall in the catchment has been consistently low since the above average rainfall (290%) in February 2022. The three month LTA percentages indicate above average values until May 2022 due to the influence of the February rainfall data. For the six and seven month periods (Spring and summer period) from March 2022 have seen notably low rainfall with 53% and 59% of LTA. The wet weather experience throughout October (151%) has seen an improvement however, both the six months (83%) and seven months (79%) to the end of October are markedly drier than the LTA.

Table 8 (2022 Monthly rainfall (in mm) Upper Derwent catchment based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)

Month	Total rainfall (mm)	LTA (1961-90)	Percentage of long term average (%)	Percentage of 3-month long term average (%)	Percentage of 6-month long term average (%)	Percentage of 7-month long term average (%)
Jan	71.8	150.1	48%	86%	86%	93%
Feb	303	104.3	290%	143%	115%	109%
Mar	49.6	124.2	40%	112%	110%	105%
Apr	55.4	101.7	54%	124%	102%	104%
May	58.7	86.8	68%	52%	104%	99%
Jun	57.8	94.9	61%	61%	90%	99%
Jul	44	90.5	49%	59%	94%	85%
Aug	57	113.7	50%	53%	53%	87%
Sep	109.8	118.3	93%	65%	63%	59%
Oct	198.9	131.7	151%	101%	83%	79%
Nov	165.55	146.5	113%	120%	91%	88%

Figure 14 (Actual rainfall as percentage of Long-Term Average (Upper Derwent Catchment) based on HADUK DRT data below highlights that excluding February, October & November 2022 every month of the year has seen below LTA rainfall in the Upper Derwent catchment. Since March 2022 cumulative rainfall (Figure 16) has been as dry or drier than all other drought years bar 1995.

October and November rainfall in the upper Derwent catchment has been above LTA. This has helped reduce soil moisture deficit and begin to refill the reservoirs, though they current remain below the rescind permit line and therefore abstraction from the reservoirs is still restricted.

Figure 14 (Actual rainfall as percentage of Long-Term Average (Upper Derwent Catchment) based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)

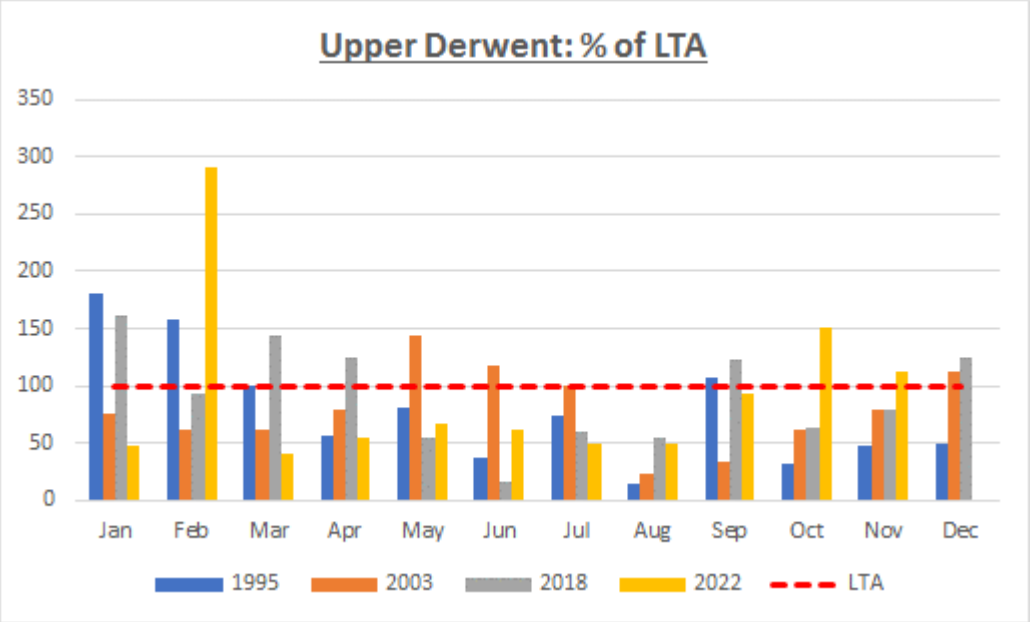
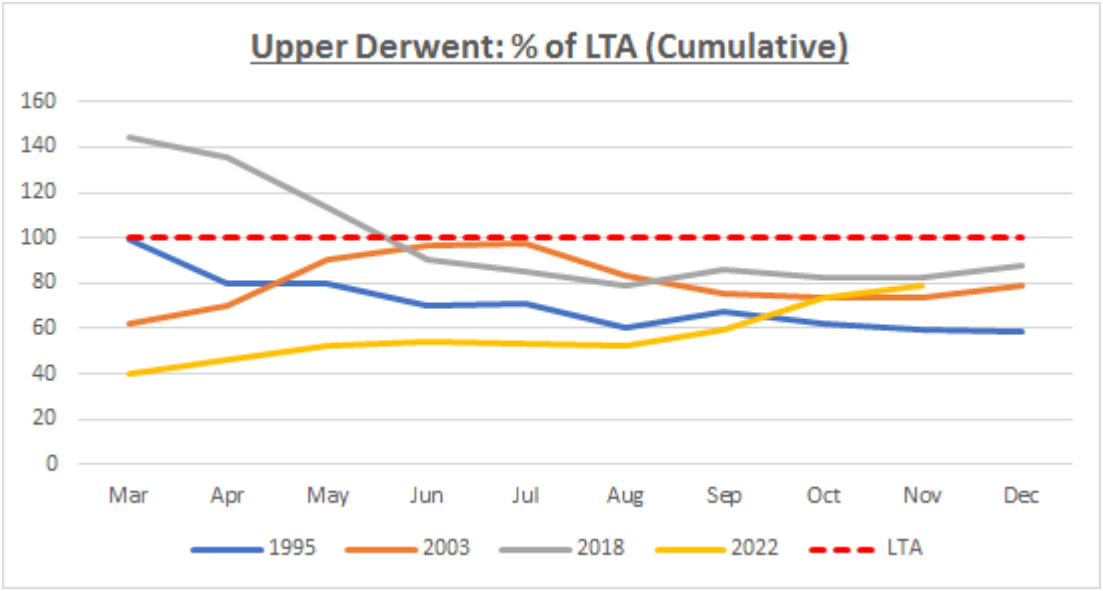


Figure 15 (Actual rainfall as percentage of cumulative Long-Term Average (Upper Derwent Catchment) based on HADUK NCIC, EA DRT data & Forecast data from 24/11/2022 by Weatherquest)



Upper Derwent Standardised Precipitation Index

SPI was also calculated for the upper Derwent catchment. Table 9 (Upper Derwent HADUK DRT data deriving SPI) illustrates similar SPI results to the whole Derwent catchment, the results indicate that the upper Derwent was even drier than the Dove Catchment. The SPIs across the summer show that it was extremely dry in the headwaters of the catchment, with July & August SPI-4 and SPI-5 being 'Extremely Dry' and August & September SPI-6 being 'Extremely Dry' (<=-2.0). The most notable being the August SPI-6 at -2.77.

September SPI-7 classifies the months March to September as 'Extremely Dry' with a value of -2.46, in comparison to the September SPI-7 for the whole catchment this was 'Severely Dry' at -1.93. This again shows that in the period since the storage at our Derwent reservoirs began to drawdown there had also been extremely dry conditions for the upper Derwent catchment.

Table 9 (Upper Derwent HADUK DRT data deriving SPI)

Month	SPI-1	SPI-2	SPI-3	SPI-4	SPI-5	SPI-6	SPI-7	SPI-8	SPI-9
Jan-22	-1.32	-0.13	-0.45	-0.33	-0.45	-0.70	-0.42	-0.80	-0.24
Feb-22	2.08	1.23	1.33	1.02	0.97	0.76	0.53	0.66	0.29
Mar-22	-1.16	1.51	0.65	0.89	0.59	0.59	0.41	0.20	0.35
Apr-22	-0.69	-1.45	1.08	0.27	0.58	0.32	0.34	0.19	-0.01
May-22	-0.53	-1.01	-1.71	0.80	0.03	0.39	0.14	0.18	0.05
Jun-22	-0.55	-1.08	-1.47	-1.97	0.42	-0.26	0.16	-0.06	-0.02
Jul-22	-1.40	-1.43	-1.76	-2.08	-2.54	-0.16	-0.75	-0.24	-0.43
Aug-22	-1.14	-1.80	-1.77	-2.05	-2.34	-2.77	-0.62	-1.12	-0.57
Sep-22	-0.02	-0.84	-1.46	-1.57	-1.81	-2.09	-2.46	-0.64	-1.07

Table 10 (2022 against the 131-year record for the Upper Derwent catchment) shows the rank of each month in 2022 against the 131-year record for periods of 1 to 7 months for the Derwent headwaters. The wet October seven month period from March through to September is ranked as the 1st driest comparable calendar period in the whole 131-year record. Furthermore, the July five month and August six month totals were also ranked the 1st driest for these periods on record. Compared to the ranking for the whole Derwent catchment, this indicates that the Derwent headwaters were even drier and thus shows clearly that the lack of inflow experienced since March to the Derwent Valley Reservoirs and subsequent drawdown is due to an exceptional shortage of rainfall.

Table 10 (2022 against the 131-year record for the Upper Derwent catchment)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
1 month	13	130	17	30	41	35	10	13	76	108	85
2 month	60	118	126	9	21	21	9	6	34	98	110
3 month	43	120	96	115	8	8	5	5	14	67	107
4 month	47	110	104	78	104	6	3	3	16	40	77
5 month	43	107	90	91	66	90	1	4	9	31	56
6 month	31	100	96	83	86	53	60	1	6	27	44
7 month	44	90	84	85	73	73	28	35	2	19	38

We have used the rankings shown in Table 8 to create rainfall return periods for each month shown in Table 10. The five month total for July, six month total for August & the seven month total for September all have a return period of 1 in 132 years. The four month total for July & August both have a return period of 1 in 44 years as well. This long-term trend illustrates that it was exceptionally dry across the spring and summer and is continuing this trend into autumn.

Table 11 (Upper Derwent catchment Return period based on DRT monthly ranking (1 = normal year))

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
1 month	10	1	8	4	3	4	13	10	2	1	2
2 month	2	1	1	15	6	6	15	22	4	1	1
3 month	3	1	1	1	17	17	26	26	9	2	1
4 month	3	1	1	2	1	22	44	44	8	3	2
5 month	3	1	1	1	2	1	132	33	15	4	2
6 month	4	1	1	2	2	2	2	132	22	5	3
7 month	3	1	2	2	2	2	5	4	66	7	3

Table 12 has used the Cunnane (1978) 1 plotting position which calculates the probability of one of the ranked values being lower than expected and categorises rainfall data into descriptive categories. This shows the single and cumulative months results for the Upper Derwent catchment, as illustrated the single months for March,

July and August are classified as 'NL' (Notably Low). When looking at cumulative values the categorisation shows 'EL' (Exceptionally Low) from June to September in at least one month from months of cumulative rainfall 2-7.

The exceptionally low rainfall in the upper Derwent catchment has mean that the Derwent Valley reservoirs have been drawn down to very low levels across the summer and Autumn and we have had to reduce abstraction from them to reduce the drawdown. We now have a permit in place which restricts our abstraction from the reservoirs and therefore puts more reliance on the Dove reservoirs.

Table 12 (Upper Derwent catchment rainfall probabilistic ranking using Cunnane (1978) Banding)

Period (Months) of Cumulative Rainfall	Period Ending in Month											
	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22
1	148.2	107.9	208.8	71.8	303.0	49.6	55.4	58.7	57.8	44.0	57.0	93.7
	N	N	AN	NL	EH	NL	BN	N	BN	NL	NL	N
	113%	74%	136%	48%	291%	40%	54%	68%	61%	49%	50%	79%
2	234.1	256.1	316.7	280.6	374.8	352.6	105.0	114.1	116.5	101.8	101.0	150.7
	N	N	N	N	NH	EH	NL	BN	BN	NL	EL	BN
	94%	92%	106%	93%	147%	154%	46%	61%	64%	55%	49%	65%
3	312.2	342.0	464.9	388.5	583.6	424.4	408.0	163.7	171.9	160.5	158.8	194.7
	N	N	N	N	NH	AN	NH	NL	NL	EL	EL	NL
	86%	86%	108%	86%	143%	112%	124%	52%	61%	59%	53%	60%
4	449.3	420.1	550.8	536.7	691.5	633.2	479.8	466.7	221.5	215.9	217.5	252.5
	N	BN	N	N	AN	AN	N	AN	EL	EL	EL	NL
	99%	82%	100%	92%	125%	119%	100%	112%	54%	58%	56%	61%
5	472.6	557.2	628.9	622.6	839.7	741.1	688.6	538.5	524.5	265.5	272.9	311.2
	BN	N	N	N	AN	N	N	N	N	EL	EL	EL
	86%	93%	95%	89%	122%	109%	109%	95%	102%	53%	56%	62%
6	649.6	580.5	766.0	700.7	925.6	889.3	796.5	747.3	596.3	568.5	322.5	366.6
	N	BN	N	BN	AN	AN	N	N	N	N	EL	EL
	102%	83%	102%	86%	115%	110%	102%	104%	90%	94%	53%	61%
7	667.8	757.5	789.3	837.8	1003.7	975.2	944.7	855.2	805.1	640.3	625.5	416.2
	N	N	N	N	N	N	N	N	N	BN	BN	EL
	91%	97%	93%	93%	109%	105%	104%	99%	99%	85%	87%	57%
8	807.6	775.7	966.3	861.1	1140.8	1053.3	1030.6	1003.4	913.0	849.1	697.3	719.2
	N	BN	N	BN	AN	N	N	N	N	N	BN	BN
	94%	88%	103%	86%	113%	101%	100%	101%	95%	94%	81%	86%
9	927.1	915.5	984.5	1038.1	1164.1	1190.4	1108.7	1089.3	1061.2	957.0	906.1	791.0
	N	N	N	N	N	N	N	N	N	N	BN	BN
	96%	91%	95%	96%	106%	105%	97%	98%	97%	91%	89%	80%

Long Term Frequency Analysis

We have undertaken a frequency analysis of the rainfall data for Upper Derwent catchment of the summer and Autumn months. We have looked specifically at the frequency of levels of cumulative rainfall in mm for the 6-month period March to August from 1891 to 2021. We have then looked at where on the distribution rainfall in from 2022 sits.

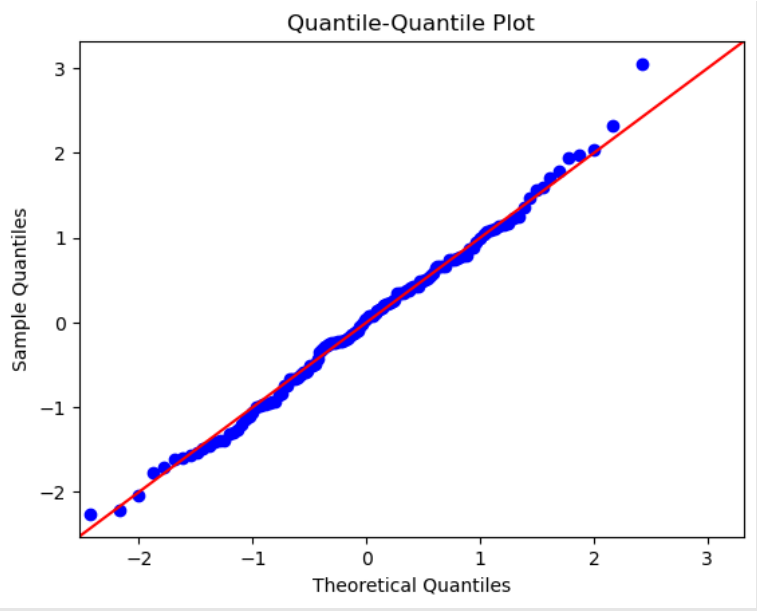
We have tested for Normality of the distribution of data:

Although there is no direct statistical test for whether a sample follows a normal distribution, the Shapiro-Wilks test can provide some confidence that the March-August rainfall dataset is normally distributed. The null hypothesis of this test is that the data follows a normal distribution, and the alternative is that it does not. The test provides evidence to reject the null hypothesis (i.e., there is evidence that the dataset is not normally distributed if the p-value is less than the 0.05 threshold. The p-value for the Mar-Aug dataset is 0.874, way above the threshold, providing no evidence that it is not normally distributed.

This can be supported visually, by considering the qq-figure below. In the figure, the red line represents a perfect normal distribution, and the blue points are our dataset. The points follow the same shape as the line, providing further evidence that it is normally distributed.

At the extremes, there may be the odd outlying point, but this not enough to warrant suspicion on the distribution, as the sample size is limited. We have made a small standard correction to the applied normal distribution to account for this.

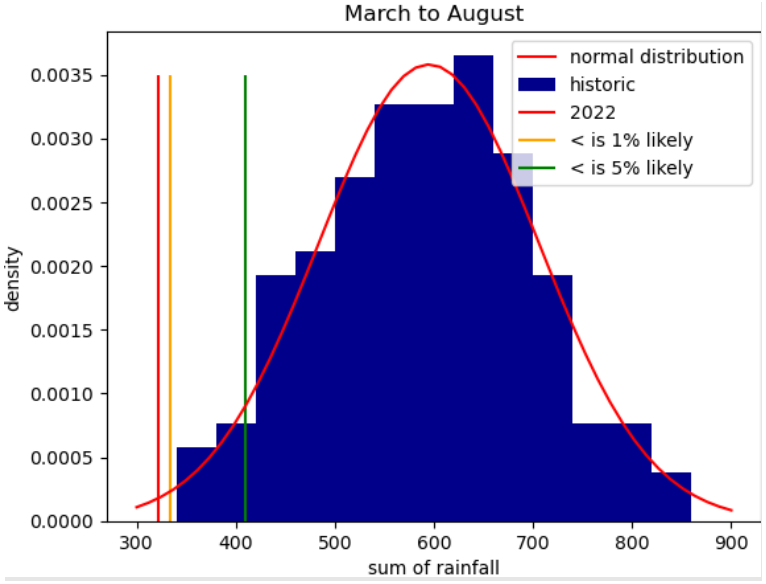
Figure 16 (GG plot of sample quantiles)



Test for "Dry Year":

Now that we have evidence to support the normal distribution, we can compare 2022 to it. The figure below shows that to get the level of rainfall seen in 2022 is less than 1 percent likely. So is in the top 1% of dry years. The actual probability for 2022 was calculated 0.008 or 0.8% which equates to a return period of around 1 in 130.5 years.

Figure 17 (Distribution Plot with showing position of 2022 Mar to Aug rainfall in the 131-year period)



4.4. There has been a prolonged period of exceptionally low rainfall locally at our Charnwood Reservoirs

Throughout the Spring, Summer and into Autumn 2022 storage in our Charnwood reservoirs in the River Soar Catchment has tracked close to the "minimum" projection which is based on the driest scenario from our record.

This has meant an increased reliance on our Dove Reservoirs as we kept abstraction at these sources within our Strategic grid as low as possible. We will need to continue to keep abstraction low at the Charnwood reservoirs to aid recovery of the reservoirs this winter.

As illustrated in Table 13 the monthly rainfall for the Charnwood catchment was notably low in April, July and August at 30%, 23% and 48% of LTA respectively. The six months to August 2022 and seven months to September 2022 saw 53% and 59% of LTA rainfall respectively.

Table 13 (2022 Monthly rainfall (in mm) Charnwood catchment based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)

Month	Total rainfall (mm)	LTA (1961-90)	Percentage of long term average (%)	Percentage of 3-month long term average (%)	Percentage of 6-month long term average (%)	Percentage of 7-month long term average (%)
Jan	23.4	61.8	38%	60%	81%	85%
Feb	86.7	52.5	165%	96%	99%	91%
Mar	40	55.9	72%	88%	95%	96%
Apr	16.3	54.3	30%	88%	73%	86%
May	48.1	57.8	83%	62%	80%	74%
Jun	36.5	61.5	59%	58%	73%	77%
Jul	11.9	51.7	23%	56%	72%	66%
Aug	31.9	66.9	48%	45%	53%	68%
Sep	54.3	55.6	98%	56%	57%	59%
Oct	92.7	56.5	164%	100%	79%	72%
Nov	127.75	63.0	203%	157%	100%	98%

Table 14 (2022 against the 131-year record for the Charnwood catchment)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
1 month	6	120	48	13	55	41	6	19	77	102	124
2 month	21	66	96	15	19	30	7	2	28	90	123
3 month	10	58	53	59	19	13	11	4	4	57	121
4 month	27	33	50	22	49	12	4	6	5	23	101
5 month	33	52	27	30	24	35	6	3	8	15	65
6 month	19	62	49	13	26	14	17	3	3	16	56
7 month	19	31	55	24	16	17	8	7	4	8	48

Table 15 (Charnwood catchment Return period based on DRT monthly ranking (1 = normal year))

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
1 month	22	1	3	10	2	3	22	7	2	1	1
2 month	6	2	1	9	7	4	19	66	5	1	1
3 month	13	2	2	2	7	10	12	33	33	2	1
4 month	5	4	3	6	3	11	33	22	26	6	1
5 month	4	3	5	4	6	4	22	44	17	9	2
6 month	7	2	3	10	5	9	8	44	44	8	2
7 month	7	4	2	6	8	8	17	19	33	17	3

Table 14 & 15 shows the rank of each month in 2022 against the 131-year record for periods of one to seven months for the Charnwood catchment and the return periods. The August five month & the August/September six month totals are ranked as the 3rd driest periods in the whole record. Furthermore, the September seven month total was also ranked at 4th and October seven month total was 8th, indicating that the Charnwood catchment has continued to be dry, which accounts for the continued storage decreases seen at the reservoirs.

Figure 18 below highlights that across spring and summer rainfall was below LTA in the Charnwood catchment. Since April 2022 cumulative rainfall (Figure 19) has been as dry or drier than all other drought years except 1995.

October and November have been considerably above the LTA, which has improved the overall storage in the reservoirs. Though Swithland reservoir still remains in licence zone C, and therefore the abstraction from the reservoirs remains restricted.

Figure 18 (Charnwood Catchment Rainfall as a percentage of Long-Term Average based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)

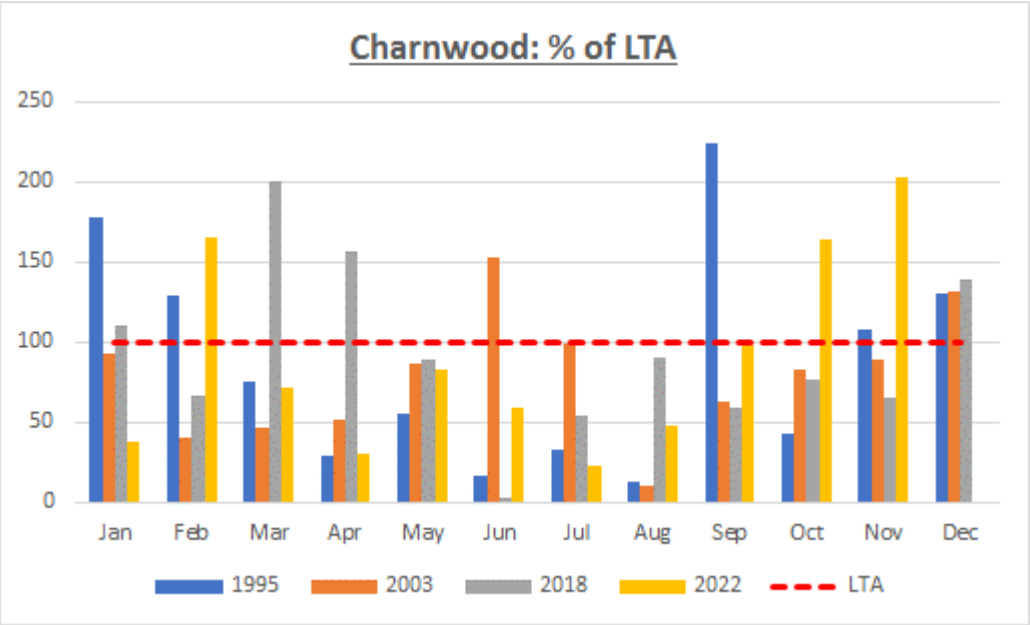
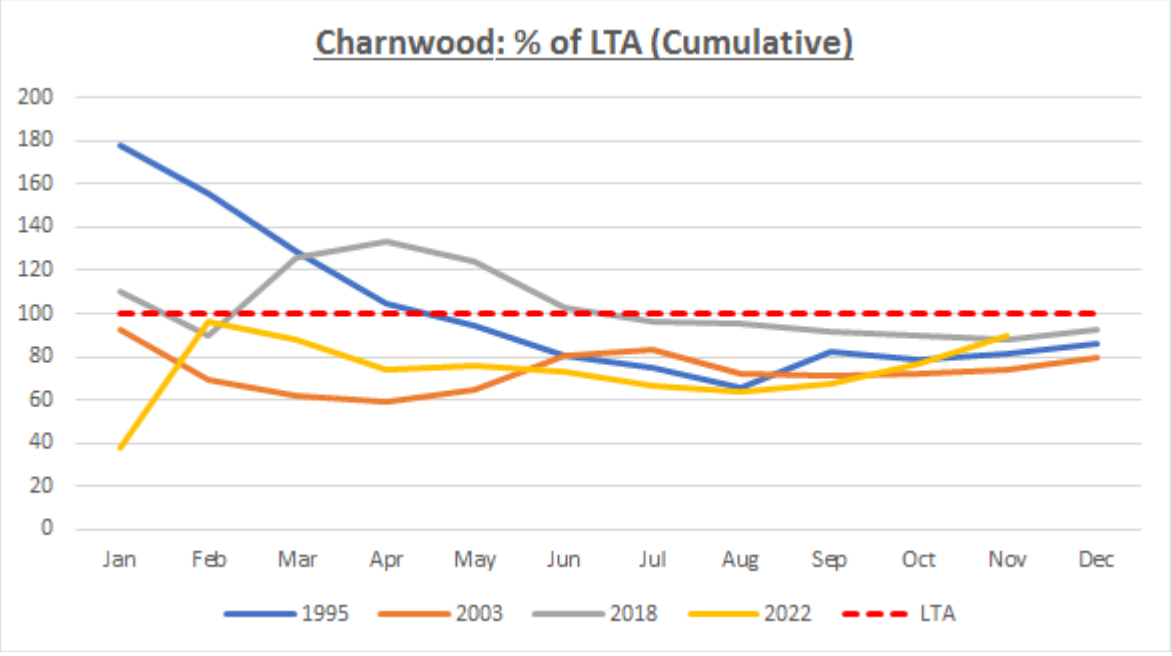


Figure 19 (Charnwood Catchment cumulative rainfall based on HADUK DRT data & Forecast data from 24/11/2022 by Weatherquest)



Charnwood catchment Standardised Precipitation Index

SPI was also calculated for the Charnwood catchment. Table 16 illustrates similar SPI results to the Dove and Upper Derwent catchment.

Over the six month period to August (SPI-6) the SPI was -2.032, meaning that the spring and summer of 2022 is categorised as 'Extremely Dry'. August's SPI-5 was also classified as 'Extremely Dry' with an SPI of -2.100.

The seven month period to September (SPI-7) had an SPI of -1.837, meaning that this period is 'Severely Dry'. This again shows that in the period since the storage at our Charnwood reservoirs began to drawdown there had also been extremely dry conditions within the immediate catchment. SPI results improve for October following rainfall within the catchment and indicate 'Near Normal' conditions for SPI-2 to SPI-6, but still 'Moderately Dry' for Octobers SPI-7 (April to October).

Table 16 (Charnwood HADUK DRT data deriving SPI)

Month	SPI-1	SPI-2	SPI-3	SPI-4	SPI-5	SPI-6	SPI-7
Jun-22	-0.221	-0.391	-1.138	-1.054	-0.283	-0.953	-0.839
Jul-22	-1.909	-1.416	-1.336	-1.859	-1.746	-0.981	-1.400
Aug-22	-0.887	-2.048	-1.706	-1.636	-2.100	-2.032	-1.323
Sep-22	-0.619	-1.565	-1.489	-1.489	-1.446	-1.862	-1.837
Oct-22	1.016	0.795	0.149	-0.648	-0.748	-0.764	-1.150

Table 17 has used the Cunnane (1978) 1 plotting position which calculates the probability of one of the ranked values being lower than expected and categorises rainfall data into descriptive categories. This shows the single and cumulative months results for the Charnwood catchment. The single one month rainfall for July is classified as 'NL' (Notably Low). When looking at cumulative values the categorisation ranks the 6 months to August as 'EL' (Exceptionally Low) and the 7 months to September 'NL' (Notably Low).

Over the longer scale cumulative periods of 9-12 months Rainfall has ranked as 'EL' (Exceptionally Low) or 'NL' (Notably Low) for July, August and September.

Table 17 (Charnwood catchment rainfall probabilistic ranking using Cunnane (1978) Banding)

Station:	Soar											
Period (Months) of Cumulative Rainfall	Period Ending in Month											
	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22	Oct 22
1	27.6	58.8	19.9	79.4	39.3	16.3	47.1	41.7	13.7	34.6	52.1	96.5
	EL	N	EL	NH	N	NL	N	N	NL	BN	N	AN
	49%	98%	37%	178%	79%	32%	90%	72%	27%	54%	101%	185%
2	117.0	86.4	78.7	99.3	118.7	55.6	63.4	88.8	55.4	48.3	86.7	148.6
	N	BN	BN	N	AN	BN	BN	BN	NL	EL	BN	AN
	108%	74%	69%	101%	126%	55%	61%	81%	51%	42%	75%	143%
3	172.0	175.8	106.3	158.1	138.6	135.0	102.7	105.1	102.5	90.0	100.4	183.2
	N	N	NL	N	N	N	BN	NL	NL	EL	NL	N
	107%	104%	62%	100%	93%	93%	67%	65%	64%	52%	60%	109%
4	202.3	230.8	195.7	185.7	197.4	154.9	182.1	144.4	118.8	137.1	142.1	196.9
	N	N	BN	BN	N	BN	N	BN	EL	NL	NL	BN
	90%	105%	88%	86%	95%	78%	92%	68%	56%	61%	63%	90%
5	270.6	261.1	250.7	275.1	225.0	213.7	202.0	223.8	158.1	153.4	189.2	238.6
	N	BN	N	N	BN	N	BN	N	NL	EL	NL	BN
	99%	92%	91%	103%	85%	82%	80%	87%	60%	56%	68%	86%
6	308.8	329.4	281.0	330.1	314.4	241.3	260.8	243.7	237.5	192.7	205.5	285.7
	BN	N	BN	N	N	NL	BN	BN	BN	EL	EL	BN
	93%	98%	83%	104%	99%	76%	84%	79%	78%	59%	63%	87%
7	409.7	367.6	349.3	360.4	369.4	330.7	288.4	302.5	257.4	272.1	244.8	302.0
	N	BN	BN	N	N	BN	BN	BN	NL	NL	NL	NL
	106%	94%	90%	94%	100%	90%	78%	82%	71%	74%	65%	80%
8	413.7	468.5	387.5	428.7	399.7	385.7	377.8	330.1	316.2	292.0	324.2	341.3
	N	N	BN	N	BN	N	BN	NL	NL	NL	BN	NL
	95%	105%	87%	99%	92%	92%	90%	77%	75%	69%	77%	79%
9	448.0	472.5	488.4	466.9	468.0	416.0	432.8	419.5	343.8	350.8	344.1	420.7
	BN	N	N	N	N	BN	N	BN	EL	EL	NL	BN
	92%	95%	98%	95%	97%	86%	92%	88%	72%	72%	72%	89%
10	488.4	506.8	492.4	567.8	506.2	484.3	463.1	474.5	433.2	378.4	402.9	440.6
	BN	BN	BN	N	N	BN	BN	BN	NL	EL	NL	NL
	92%	93%	90%	104%	94%	91%	86%	89%	82%	70%	75%	83%
11	600.3	547.2	526.7	571.8	607.1	522.5	531.4	504.8	488.2	467.8	430.5	499.4
	N	N	BN	N	N	BN	BN	BN	NL	NL	NL	BN
	103%	93%	88%	96%	102%	88%	91%	85%	84%	79%	73%	85%
12	702.6	659.1	567.1	606.1	611.1	623.4	569.6	573.1	518.5	522.8	519.9	527.0
	N	N	BN	N	N	N	BN	BN	NL	NL	NL	NL
	109%	102%	88%	94%	95%	97%	88%	89%	80%	81%	81%	82%

4.5. A high soil moisture deficit has led to exceptionally low run off in the East Midlands region

Storage at our reservoirs in the east of our region have been affected by the exceptionally low rainfall experienced since the start of March 2022. Soil Moisture Deficit increased throughout the summer, meaning that when rainfall has occurred it has been soaked up by the soil. Runoff into the reservoirs has been lower than normal since March, after the high level of rainfall that occurred during February.

One effect of the exceptionally low rainfall was to generate very high soil moisture deficits (SMD). Figure 20 (East Midlands Soil Moisture Deficit source: EA Monthly water situation report Oct 2022) taken from the EA's October water situation report, shows SMD across the East of the Severn Trent region compared with the LTA, and the historic extremes. From March 2022, SMD was tracking below the LTA and were approaching historic minimums between the June to mid-October period. October's rainfall has helped SMD begin to recover closer to the LTA. Though SMD is still relatively high.

Figure 20 (East Midlands Soil Moisture Deficit source: EA Monthly water situation report Oct 2022)

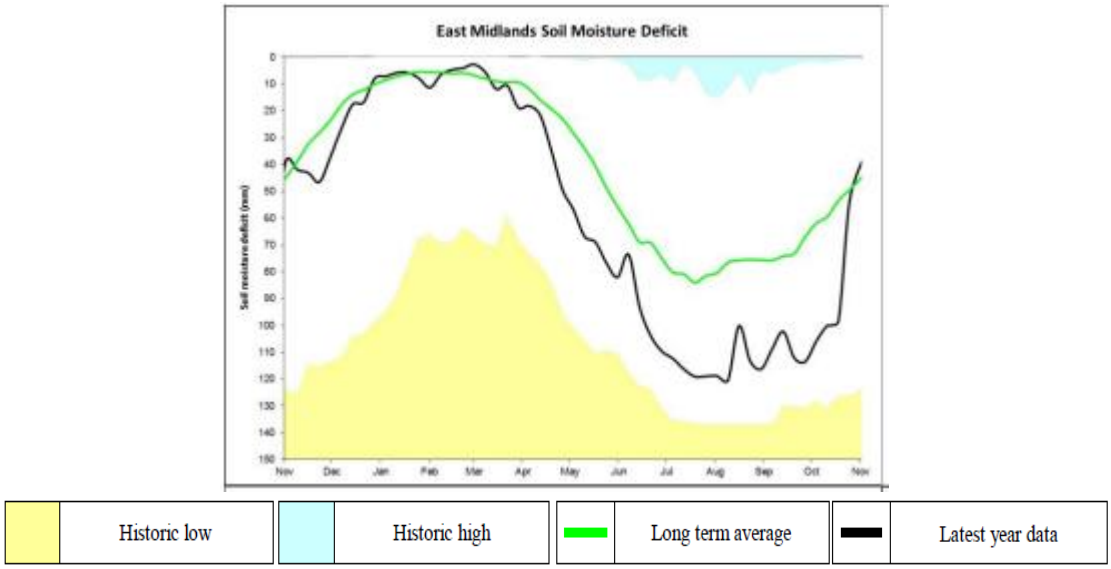
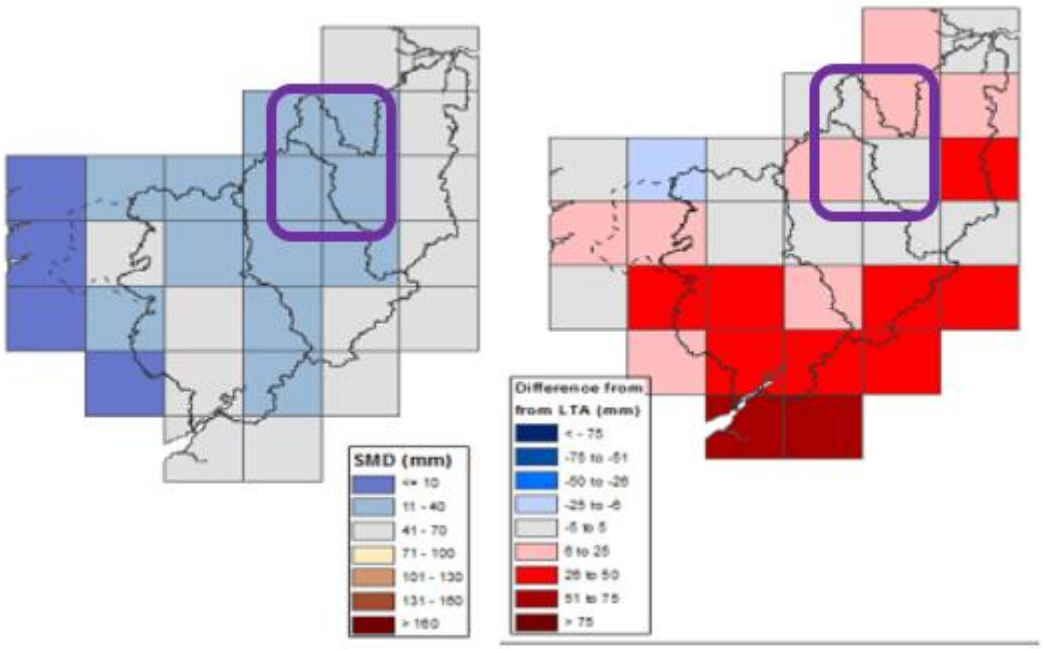


Figure 21 (Soil moisture deficit map source: EA Monthly water situation report Oct 2022)



5. Operational measures to try and avoid the need for this permit

Throughout 2022 we have taken proactive measures to manage our supply network in a way that would avoid the need for us having to make this drought permit application. We describe in this chapter the different actions we have taken throughout the year, and the alternative measures we have considered before making this Drought Permit application.

Many of these actions and the associated triggers are described in our Drought Plan and were reviewed when we consulted on our updated Drought Plan prior to publication in September. In summary, Table 18 (Drought Plan actions taken throughout 2022) illustrates the escalating operational actions that are described in our Drought Plan and shows that we have deployed all of the actions that will have a direct benefit on protecting our strategic grid reservoirs storage. Each of the actions marked as green has been completed and each of these actions can directly help to balance demand across our Strategic Grid.

Table 18 (Drought Plan actions taken throughout 2022)

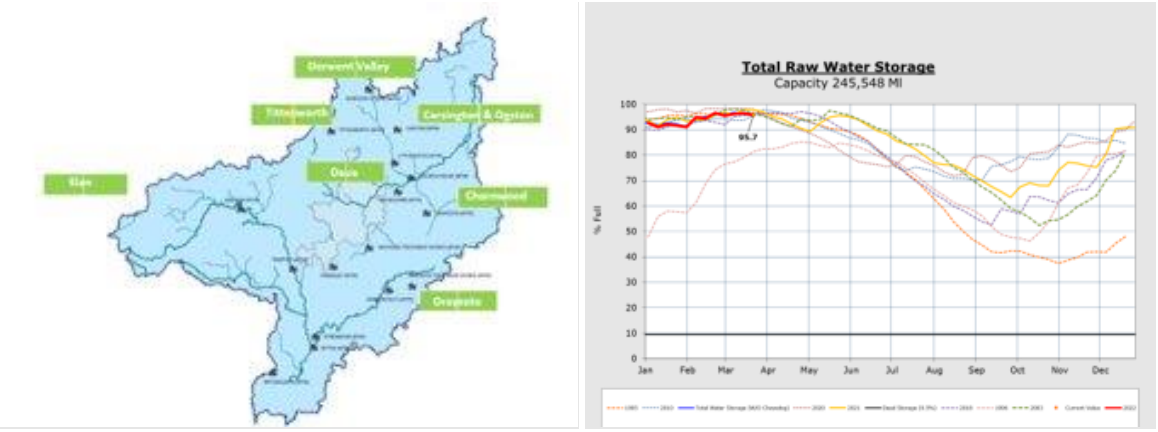
Trigger Level / Action	Supply Activities	Started	Reservoir Influence / Comments	Status
Trigger Hit 24th April Level 1a / Action 2	Raise Awareness Convene Tactical DAT	April 2022	Increased Control of reservoirs	Complete
Action 2 b	Test Drought Actions Understand timeline for a drought permit	May 2022	NA	Complete
Action 2 c	Consider Staged Reduction in abstraction from Derwent Reservoirs	Early May to early July 2022	Saved 700Ml in anticipation of hot weather, 5575Ml less abstracted than prior year	Complete
Trigger Hit 13th June Level 1b / Action 3	Liaise with EA and Yorkshire Water	April 2022 Onwards	Through our Liaison Yorkshire reduced their take and banked 100Ml of water by June.	Ongoing
Level 1b / Action 4	Review Maintenance Schedule	May 2022 Onwards	Re-phased maintenance work to allow reduced abstraction from the reservoirs so recorded in action 2c and Action 7	Ongoing
Level 1b / Action 5	Maximise abstractions depending on storage and flows	April 2022 onwards	We have increased our abstraction on our river sources on the lower river Derwent which support reductions in abstraction from the Derwent Valley Reservoirs. For example, Combined abstraction on these two sources has increased by around 20 Ml/d in 2022 compared to 2021	Ongoing
Level 1b / Action 6	Consider importing via Elms Farm – depends on demand and availability – Supports Derwent Valley, Charnwood and Dove Reservoirs	April 2022 onwards	We have not imported via Elms Farm as we have been balancing Water Resource issues on the East and West of our Strategic Grid. We have however reduced our average flow via elms farm by around 3 Ml/d as compared to 2021 which would be considered a "normal year".	Ongoing
Level 1b / Action 7	Reduce Abstraction to min sustainable from D V Reservoirs – This action increases demand on our River sources and on Dove Reservoirs	21st July 2022	We again reduced abstraction from the reservoirs to our works at the end of July towards its sustainable Minimum flow and have since the middle of August kept the work at sustainable minimum apart from for a very few days. This has saved over 1000Ml based on our agreement with Yorkshire Water or over 5000Ml between Apr-Sept compared to our abstraction in 2021.	Ongoing
Level 1b / Action 8	Consider Ogston Reservoir Abstraction reduction	NA	This option does not support Derwent Valley Reservoirs and is in the plan to support Ogston Reservoir	
Level 1b / Action 9	Use Bowmer Rough	August 2022	We have been reversing our flow to use Ogston Reservoir abstraction, at around 10 Ml/d since mid-	Ongoing

Trigger Level / Action	Supply Activities	Started	Reservoir Influence / Comments	Status
			August, once we had brought demand down in the area supplied by Ogston.	
Level 1b / Action 10	Stop Abstraction from Ogston reservoir	NA	This option does not support Derwent Valley Reservoirs and is in the plan to support Ogston Reservoir.	
Level 1b / Action 11	Prioritise Carsington refill	Oct 22	We have begun to refill Carsington now river flows are currently at Normal levels. We have increased Carsington by 10% since the middle of October	Ongoing
Level 1b / Action 12	Reduce Langley Mill	May Onwards	We have optimised use of the Langley Mill transfer	Ongoing
Level 1b / Action 13	Strelley Support for Misk Hill	April onwards	We have increased flow between these control groups whenever available across this period	Ongoing
Level 1b / Action 14	Strelley from Notts Ground Water	April onwards	We have optimised our GW sources in the Notts area to help minimise imports from the Strategic Grid	Ongoing
Level 1b / Action 15	Reduce Kings Corner	April onwards	We have reduced this transfer from Strategic Grid to Nottingham, taking on average 2 Ml/d less in 2022 than in 2021	Ongoing
Level 1b / Action 16	Consider releases from Carsington	July Onwards	We have been releasing up to 130 Ml/d across the summer to support abstraction on the River Derwent thus reducing abstraction from the Derwent Valley Reservoirs. Now R Derwent has higher flows this has ceased.	Oct 22
Level 1b / Action 17	Consider Imports from Elsewhere and rezoning	June Onwards	We have balanced all imports and exports and continue to look at potential rezones where the network allows. An example is the reverse flow from Bowmer Rough.	Ongoing

5.1 We made sure we had sufficient reservoir storage in time for summer 2022

Figure 22 (Raw water availability status as of 21 March 2022) illustrates that going into April 2022 storage levels at all our reservoirs were on target for the time of year.

Figure 22 (Raw water availability status as of 21 March 2022)



Overall, as a result of our proactive actions our strategic water sources were at target levels in at end of March 2022, meaning that we entered the Spring in a strong water resource position. Table 29 (Raw Water Storage Summary March 2022) shows the overall raw water storage position for our strategic sources in March 2022 and demonstrates that overall reservoir storage was above our target position of 95% going into the summer period.

Table 29 (Raw Water Storage Summary March 2022)

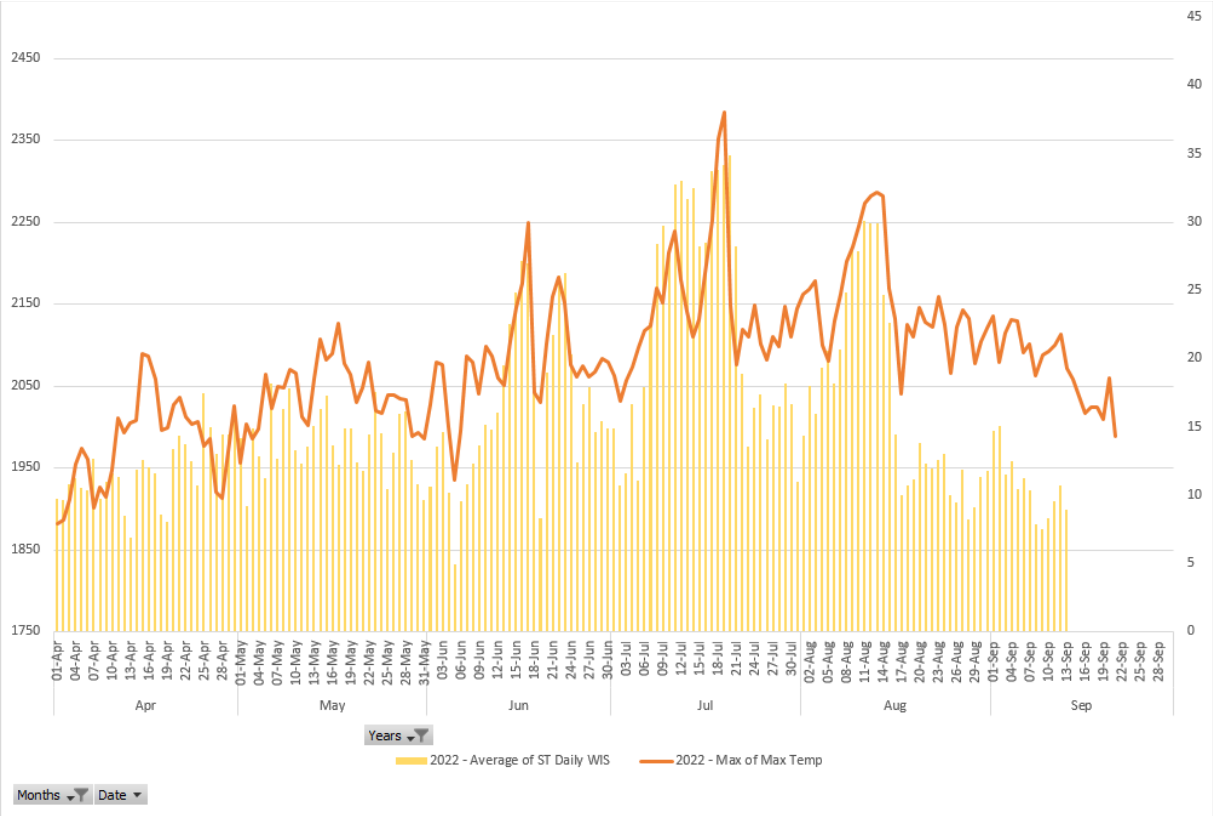
WATER RESOURCES RESERVOIR STORAGE SUMMARY 21 March 2022								RAG Status / Zone	Projected RAG / Zone in Aug - Dry 30th %ile
RESERVOIR	Pumped or Natural Fill	CAPACITY (Ml)	LAST WEEK'S STORAGE %	LAST WEEK'S STORAGE (Ml)	CURRENT STORAGE %	CURRENT STORAGE (Ml)	Diff %		
OGSTON	Pumped & Natural	6050	81.4	4925	79.9	4834	-1.5	B	B
TITTESWORTH	Natural	6440	99.4	6401	97.3	6266	-2.1	B	B
ELAN VALLEY	Natural	99500	99.1	98585	98.3	97809	-0.8	B	B
DRAYCOTE	Pumped	23000	88.4	20330	89.3	20539	0.9	B	B
DERWENT VALLEY		46345	**98.8**	**45791**	**95.3**	**44173**	**-3.5**		
Howden	Natural	8998	97.0	8728	88.0	7918	-9.0		
Derwent	Natural	9478	97.0	9194	92.0	8720	-5.0		
Ladybower	Natural	27869	100.0	27869	98.8	27535	-1.2	B	B
CARSINGTON	Pumped & Natural	36331	97.5	35423	97.6	35459	0.1	B	A
DOVE		19845	**93.1**	**18477**	**93.5**	**18563**	**0.4**		
Foremark	Pumped	13190	92.3	12174	92.5	12201	0.2	Above Licence Curve B	Above Licence Curve B
Staunton	Pumped	6655	94.7	6302	95.6	6362	0.9		
CHARNWOOD		4756	**99.3**	**4722**	**100.0**	**4756**	**0.7**		
Swithland	Natural	2228	98.7	2199	100.0	2228	1.3	In Licence zone B	In Licence zone B
Cropston	Natural	2528	99.8	2523	100.0	2528	0.2		
BARTLEY/FRANKLEY	Pumped	3281	80.4	2638	85.5	2805	5.1	NA	NA
WHITACRE	Pumped & Natural	2160	87.0	1879	84.8	1832	-2.2	NA	NA
CLYWEDOG	Natural	49936	95.9	47889	96.4	48138	0.5		
TOTALS		**247708**	**96.6**	**239169**	**95.7**	**237035**	**-0.9**		
TOTAL Incl. Clywedog		**297644**	**96.4**	**287058**	**95.8**	**285173**			

5.2 We acted early to protect Strategic Grid Raw Reservoir storage

As outlined above in Section 4, as the spring and summer of 2022 has progressed, we experienced exceptionally dry and hot weather conditions which led to high demand for water in early summer and mid-summer and exceptionally low inflow into our raw water reservoirs.

The total company demand of over 2300 Ml/d in July was the highest recorded, this exceeded the peak at the height of COVID.

Figure 23 (Total demand for water year to date 2022)



A combined effect of extremely high demand for water in early summer, hot temperatures and exceptionally low rainfall led to an increased draw down in the storage at across our Strategic Grid reservoirs by the end of the summer. Table 20 (Raw water storage summary 19 September 2022) demonstrates that our overall raw water storage had reduced from 96% full to just 43% by early Autumn. Within our Strategic Grid zone our Elan Reservoirs (34%), Derwent Valley Reservoirs (30%) and Charnwood reservoirs (38%) had been particularly effected by the exceptional shortage of rainfall. We had during the summer taken the operational decision to reduce output from these reservoirs to conserve storage.

Table 20 (Raw water storage summary 19 September 2022)

WATER RESOURCES RESERVOIR STORAGE SUMMARY 19 September 2022							
	Pumped or Natural Fill	CAPACITY	LAST WEEK'S STORAGE		CURRENT STORAGE		Diff
		(Ml)	%	(Ml)	%	(Ml)	%
OGSTON	Pumped & Natural	6050	67.4	4078	67.1	4060	-0.3
TITTESWORTH	Natural	6440	35.8	2306	34.4	2215	-1.4
ELAN VALLEY	Natural	99500	37.3	37094	34.1	33959	-3.2
DRAYCOTE	Pumped	23000	72.2	16606	71.9	16537	-0.3
DERWENT VALLEY		46345	**32.3**	**14990**	**30.5**	**14139**	-1.8
Howden	Natural	8998	12.6	**1134**	13.3	**1197**	0.7
Derwent	Natural	9478	27.7	**2625**	25.7	**2436**	-2.0
Ladybower	Natural	27869	40.3	**11231**	37.7	**10507**	-2.6
CARSINGTON	Pumped & Natural	36331	52.8	**19183**	48.3	**17548**	-4.5
DOVE		19845	**59.4**	**11779**	**57.0**	**11310**	-2.4
Foremark	Pumped	13190	61.7	**8138**	58.7	**7743**	-3.0
Staunton	Pumped	6655	54.7	**3640**	53.6	**3567**	-1.1
CHARNWOOD		4756	**41.0**	**1949**	**38.5**	**1833**	-2.4
Swithland	Natural	2228	49.6	**1105**	46.3	**1032**	-3.3
Cropston	Natural	2528	33.4	**844**	31.7	**801**	-1.7
BARTLEY/FRANKLEY	Pumped	3281	94.2	**3091**	94.4	**3097**	0.2
WHITACRE	Pumped & Natural	2160	61.1	**1320**	58.7	**1267**	-2.4
CLYWEDOG	Natural	49936	48.0	23969	44.4	22172	-3.6
TOTALS		**247708**	**45.4**	**112394**	**42.8**	**105965**	**-2.60**
TOTAL Incl. Clywedog		**297644**	**45.8**	**136364**	**43.1**	**128137**	**-2.76**

Figure 24a (Derwent Valley Storage 19 September 2022) illustrates the rapid draw down that we experienced at our Derwent Valley Reservoirs and shows how storage had fallen to 30.5% by mid-September. Figure 24b (Charnwood Storage to end Sept 2022) illustrates equally sharp drawdown, but also shows that we managed to hold these reservoirs higher than 1995 and 2018, largely through balancing with abstraction from the Dove reservoirs.

Figure 24a (Derwent Valley Storage 19 September 2022)

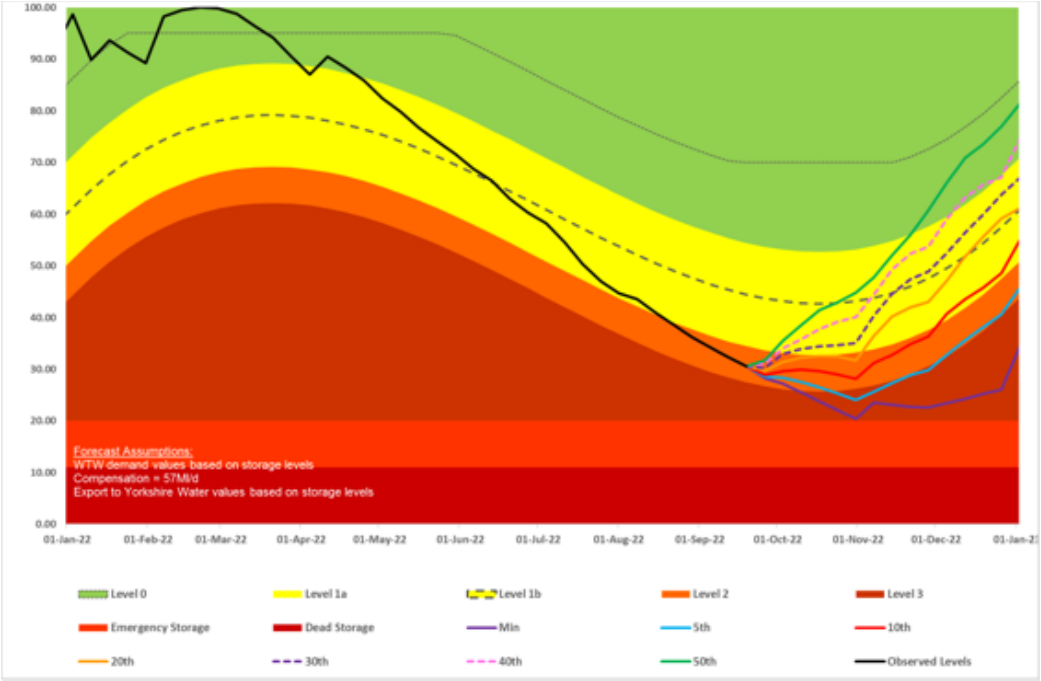
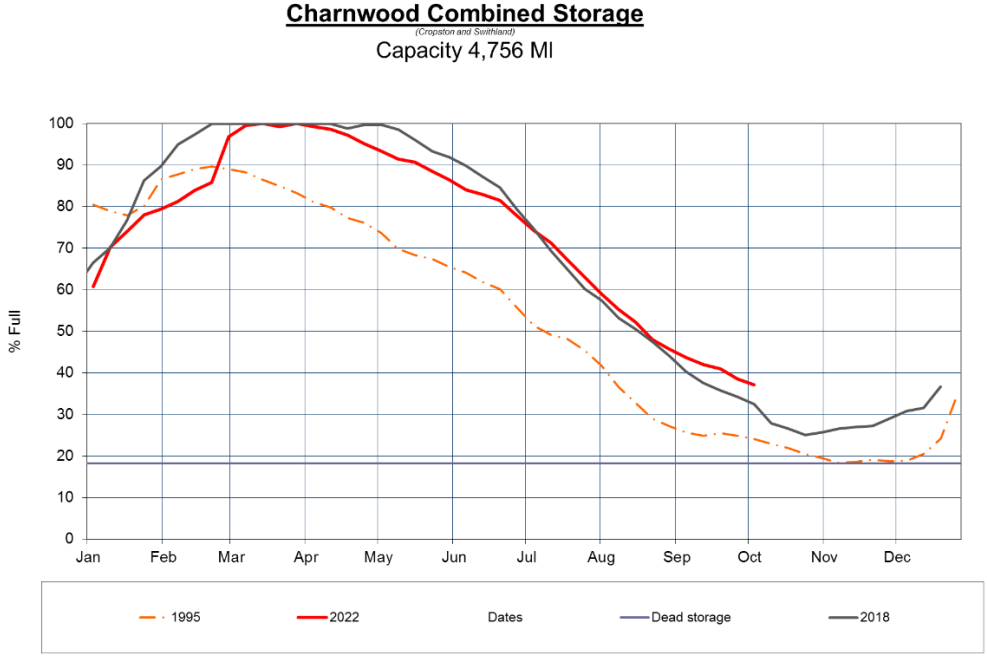


Figure 24b Charnwood Storage to end Sept 2022

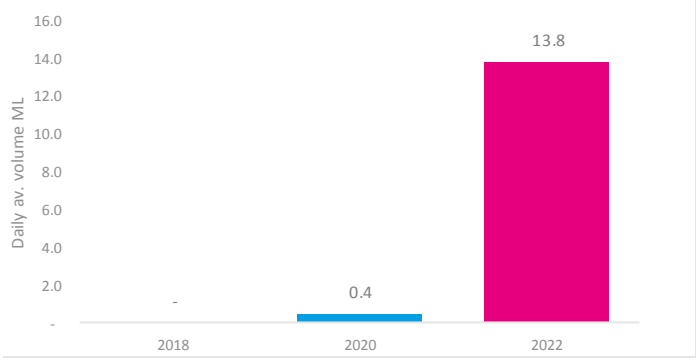


Other Actions undertaken

Our Strategic storage would have been more significantly impacted had we not taken a number of proactive actions during the summer months to change our normal water production activities to minimise the demand on our impounding reservoirs. Throughout June, July and August hot weather event we took a number of operational actions across our Strategic Grid to allow our water treatment and distribution system to meet the exceptionally high levels of customer demand. Highlights included:

- Initiating our internal drought action team in May with a primary focus of preparing for the forecasted warm summer
- Testing of summer readiness protocols and operating scenarios well in advance of the summer
- Pre-emptively initiating our hot weather incident response protocol on 18th June in response to the forecast weather conditions and expected increase in demand for water despite triggers not being met. This included actions such as increased operational and maintenance provisions, cessation of all tariff management at water production sites.
- When we experienced extreme weather periods, we used tankering and over-pumping to move 14 Ml/d of water from areas of surplus to deficit. This was significantly more than during the last extreme hot weather experienced in 2020 as shown in Figure 25 (Av. ML discharged via over pumping during hot weather).This increase is reflective of the additional investment we have made to grow our in-house capabilities.

Figure 25 (Av. ML discharged via over pumping during hot weather)



- Re-phased intrusive maintenance activities and re-prioritised planned restrictions or outages wherever possible to maintain a continuous supply of treated water.
- Maximising bulk supply imports from neighbouring companies.
- Accelerating several ongoing capital projects where they could facilitate an increase in our water treatment and distribution capability.
- Rezoning and re-valving large parts of our network to minimise the impact on customers.
- Releasing additional water from Carsington Reservoir into the River Derwent from 28th June in order to support our downstream abstractions at two major water treatment works which feed into the strategic grid, this has meant we have been able to keep these abstractions running at close to maximum flows of 90 Ml/d and over 100 Ml/d, had we not taken this approach these works would have been severely restricted or switched off, which in turn would have put significant demand on Derwent Valley Reservoirs, Charnwood Reservoirs and Dove Reservoirs.
- Maximising the use of our regional Strategic Grid assets to meet customer demand and manage the risk to water resource availability. For example, we changed and managed the flows of water between Birmingham and the wider Grid as necessary to balance the abstraction and storage risks for Elan and Frankley & Bartley reservoirs with other water treatment works, including those that abstract from Derwent Valley, Charnwood Reservoirs and Dove Reservoirs. We utilised our valve network to continuously manage and balance the flow between the North and South Grid.

Managing our water treatment works – Derwent and Charnwood

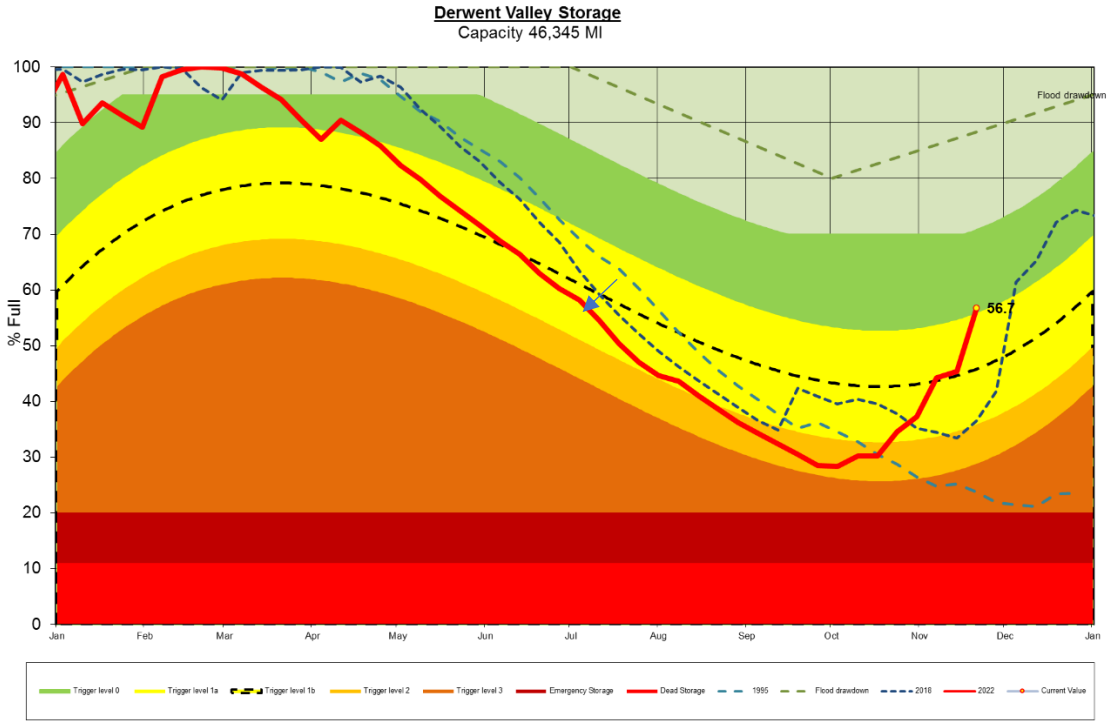
Derwent Valley

Our Upper Derwent Water Treatment Works processes water from the Derwent Valley raw water reservoirs (Howden, Derwent & Ladybower), and can produce a maximum of 185 Ml of treated water per day. The Derwent Valley Aqueduct (DVA) then carries the treated water through to our treated water reservoir forming part of our strategic grid.

Since April 2022, we reduced our treatment works output where possible below the levels in the agreement with Yorkshire Water as can be seen if **Error! Reference source not found.** (Section 5). This was in anticipation of potential hot weather over the summer period, prevailing weather conditions at this time were dry. We incrementally reduced the works further at the end of June and start of July below the agreed abstraction thresholds. Notably, despite a temporary increase in abstraction due to the extreme hot weather in mid-July, we reduced water treatment works output again to continue to preserve Derwent Valley raw water storage from the 21st July, we reduced treatment works output below the 115 Ml/d state line to 100 Ml/d for the remainder of July, following some site modifications and process testing the works was further reduced to 95 Ml/d by mid-August. Since September the works has remained on an average of less 100 Ml/d.

Figure 26 (Derwent valley reservoir projections and indication of when decision was taken to limit output below 115 Ml/d) illustrates that at the point we made the decision to further reduce treatment works output with any increases requiring director approval - the Derwent Valley Reservoirs were at 50% and in the 'Level 1b' storage zone at this point. We implemented this process to ensure treatment work outputs remained at the minimum sustainable level, due to the weather forecast for continued warm dry weather into September and our probabilistic reservoir storage projections.

Figure 26 (Derwent valley reservoir projections and indication of when decision was taken to limit output below 115 Ml/d)



Due to the exceptional shortage of rainfall in the Upper Derwent catchment from March to September, and the very low level in the reservoirs we were granted a drought permit at Derwent Valley Reservoirs on 14th October 2022, this permit was to reduce the compensation flow from the reservoirs by around 20 Ml/d to aid refill of the reservoirs. The permit includes a condition which restricts the total (Severn Trent and Yorkshire Water) abstraction from the reservoirs to 135 Ml/d on a 60 day rolling average. This condition restricts abstraction to Severn Trent to around 102 Ml/d. A direct consequence of this restriction on abstraction has been a continued increased reliance on the Dove Reservoirs abstraction that will continue until the Derwent Reservoirs permit ends, either when the reservoir reaches the rescind line (Light green on figure 26) or March 31st. As can be seen during November the reservoirs have begun to increase, had this restriction not been put in place it is likely we

would now have started to increase our abstraction from Derwent Valley and be able to reduce abstraction at Dove.

As stated above direct result of reducing abstraction at Derwent Valley is an increased reliance on our other sources, where possible we have used our run of river sources to utilise available flow in the river, but we have also had to take increased abstraction from our pumped storage reservoirs such as Carsington and the Dove reservoirs.

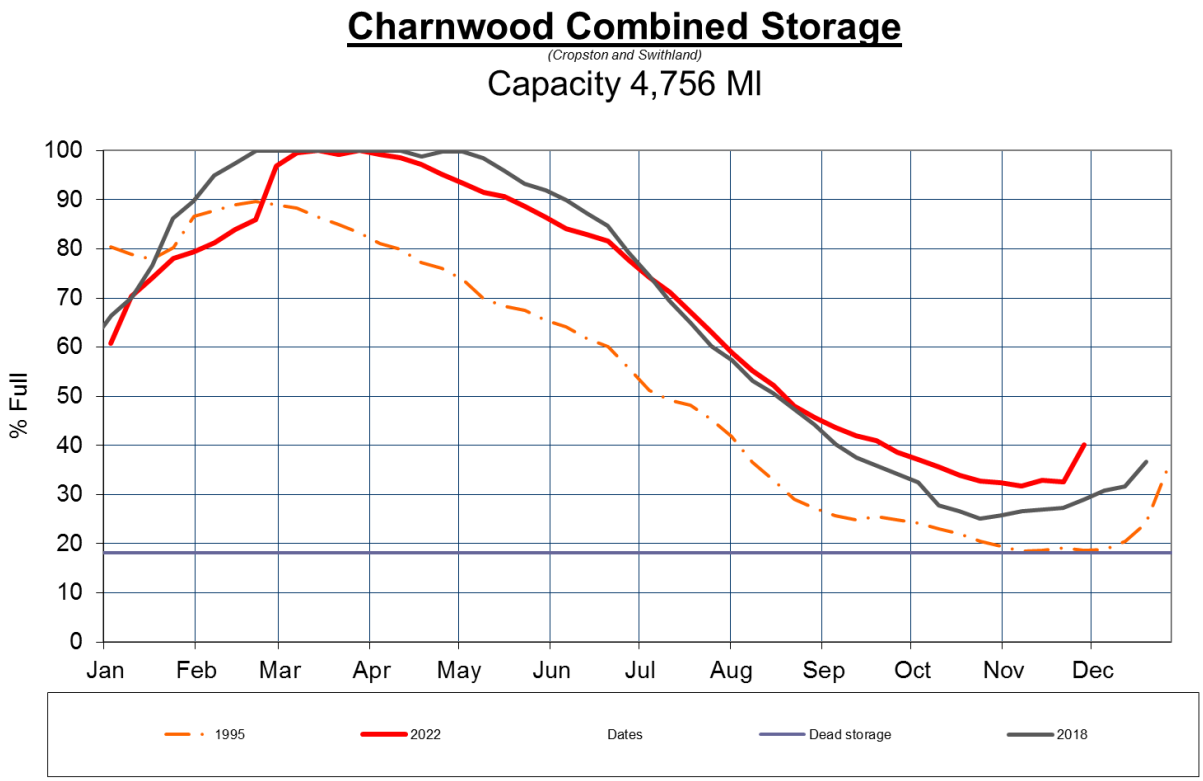
Charnwood

Similar to Derwent Valley reservoirs, as the hot and dry weather continued through summer and autumn 2022 we took proactive steps to protect storage at our Charnwood reservoirs in Leicestershire. Figure 2 7 shows how reservoir storage steadily declined through the summer months. Our Drought Action Team monitored the storage situation on a weekly basis and risk assessed the likely future rate of drawdown using probabilistic projections. Abstraction from the reservoirs has been on minimum flow of around 14 Ml/d since mid-august.

By November the reservoirs had fallen to around 32% of capacity and were projected to continue falling. Our water resource modelling showed that there was still a significant likelihood that the reservoirs would not refill in time for spring 2023 without further proactive action. Therefore, to manage that risk and to maximise the potential for reservoir refill in time for 2023 have taken the proactive decision that in December 2022 we will stop all abstraction from Charnwood reservoirs for at least six weeks. As can be seen the reservoirs have begun to turn at the end of November 2022, however they still remain exceptionally low.

One consequence of this decision to stop all abstraction from Charnwood will be that we need to continue maximising our abstraction from the Dove reservoirs to make up for the lost output.

Figure 27 (Charnwood Combined Storage)



5.3 Operational Changes we will make to avoid future drought related problems

Our operating target for the rest of winter is to minimise the amount of water we put into supply from Derwent Valley Reservoirs and Charnwood reservoirs to help ensure the reservoirs are full by Spring 2023 , this will require increased output from Dove reservoirs between now and March 2023, and will avoid issues in summer 2023

Within our draft Water Resource Management Plan (dWRMP) that was published on the 16th November we have set a series of supply improvements to secure additional deployable output and transition over the coming AMPs to a greater level of drought resilience.

Further to this we are committed to reviewing how we manage the risks posed by an emerging drought, using the learning from this year's drought. For example:

- We are planning a thorough internal 'lessons learned' workshop with all areas of our drought action team (operational, tactical and strategic to capture what went well and what could be improved.
- We plan to hold a 'lessons learned' workshop with the Environment Agency to again capture what went well and what could be improved between the organisations for future events.
- We will review our most recent Drought Plan and review the escalation triggers and available actions. If deemed necessary, we will update the plan and re-consult on it to reflect our latest understanding of drought risk and options.

5.4 Other options considered and reasons for rejection

The drought management actions we have taken follow the list of escalating options that are described in our Drought Plan. We have prioritised those activities that have benefits attributed to storage preservation within with in our Strategic Grid Reservoirs. There are two items listed in our North Grid plan that would have acted contrary to this and as such they have not been deployed.

Over and above our drought plan we have taken action to improve treatment capacity at neighbouring works, for example accelerated membrane replacements at one of our sources on the River Derwent. We have rezoned parts of our system and deployed tankers to discrete areas, for example, we tankered into an area of Derbyshire to support high demand as opposed to using water from the strategic grid. These actions have enabled demand on our more at risk sources to be reduced.

With exception to our year two Drought measures that we are actively reviewing and seeking to accelerate deployment, there are no alternatives that can be deployed this year in place of a Drought Permit.

We have a dedicated workstream established to evaluate alternative sources that could be deployed to aid refill or act as compensation (including named year two drought options). This review is live, ultimately any option would require support of both the Drinking Water Inspectorate and Environment Agency and may require additional infrastructure to deploy. We will continue to work closely with our stakeholders as feasibility assessments develop.

6. We have continued to reduce leakage across our network

Leakage, much like river water quality, is a totemic issue for our sector. Ofwat was right at its last price review to point to a levelling out of the pace of leakage improvements achieved by our sector (with the majority of the 40% reduction achieved between 1996 and 2020 occurring in the early part of this period). This flattening in progress was in part because, historically, water availability made it uneconomic to drive further step changes. However, we fully recognise that in the prevailing circumstances this no longer the appropriate approach. We

therefore embraced Ofwat's challenge of achieving a 15% (69.2 Ml/d) reduction by 2025, we have also committed to achieving a 50% reduction by 2045 – five years ahead of the National Infrastructure Commission's target.

We have met our leakage reduction regulatory targets for ten out of the last eleven years (the exception being 2017/18 reflecting challenges caused by the 'Beast from the East') and, are currently on track for this year. Since Financial Year 2020/21 we have delivered a 3.4% (15.9 Ml/d) reduction on leakage from our benchmark position in 2019/20, in line with our regulatory target of 15% by 2025.

At the start of the financial Year, 2022/23, we will be delivering a very significant 30 Ml/d reduction in annual leakage, which would deliver a further 2.3% reduction on our three year average performance and is the equivalent of saving twelve Olympic sized swimming pool per day.

This year we have experienced very challenging operating conditions as the prolonged dry weather has meant soil conditions have caused more mains to burst. Despite this, we remain on track to deliver reductions this year in line with our plans. The key factors that have supported our strong performance on leakage are as follows:

- We have invested in our people by creating a leakage apprenticeship scheme, with 75 apprentices joining us over a three year period, costing £1.5m.
- We have increased resources with 30 extra Water Network Technicians, taking our total to 161 FTE looking for leaks and an extra 20 repair teams fixing them.
- Proactively targeting to locate 25,000 leaks this year, compared to 20,000 last. We are currently on track to locate c.28,000, 40% more than last year, including 10,000 private side leaks. This is in addition to the leaks reported by our customers - normally c.50% of our total leaks. Total expenditure on leakage find this year is expected to be in excess of £20m approximately £2m more than 2021 and £4m more than 2019.
- In the last five years we have increased repairs on leaky pipes by 25% (in 2017/2018 we fixed 29,662 leaks and in 21/22 we fixed 37,133.)
- We are using drones and satellite images with various cameras that detect leaking pipes through something as subtle as a temperature change. Developing our internal capability by surveying our reservoirs and trunk main surveys and rural areas. We currently have two drone pilots and are looking to expand this team very soon
- We have been using AI technology to analyse our 30,000 acoustic loggers to identify leaks more quickly on our network. Over a six-month period, this AI generated c.2.5k Points of Interest, with a confirmed 769 leaks raised so far. We continue to work with this innovation and will be making some improvements to our organisation from September to take advantage of these benefits
- Continued support of our most vulnerable customers by assisting them to reduce leakage on supply side pipe work.
- We have accelerated our AMP7 Pressure Management schemes. Installing and optimising 120 new Pressure Reducing Valves this year, this was originally planned to be delivered over 3 years. Installation of Pressure Reducing Valves allows us to manage night-time pressure through our District Metered Areas (DMAs), by reducing the pressure we reduce the flow rate in the DMA and reduce leakage. This activity has so far delivered an estimated 3.7 Ml/d leakage reduction and on track to deliver 6.7 Ml/d by year end. 0.7 Ml/d ahead of target.
- We will proactively service and inspect 833 pressure reduction valves across our network by end 2022-23, and have completed 653 so far, ahead of plan by c.100 Also optimising existing pressure reducing valves where possible across our network.
- We are taking steps to improve our understanding of customer water consumption utilising our AMP7 Proactive and Green Recovery smart metering roll outs. We are utilising this data to understand customer behaviours and consumption patterns in real time. In 2021/22 we proactively installed

110,000 meters with another 227,000 planned to be installed by 2025. As part of our Green Recovery programme, we are installing 157,000 AMI (Advanced Meter Infrastructure) in the Nuneaton area.

Additionally, we are taking steps to improve our understanding of the additional customer water consumption we observed during the hot weather period. Using our small area monitors, commercial consumption monitors and half yearly consumer meter readings we will gain greater confidence in our ability to differentiate between true increases in water consumption and leakage.

7. We have managed our planned outage approach and reduce unplanned outages to ensure our resources are used effectively

7.1 Current Performance

We have kept outage of supplies within the water resource zone to a minimum to allow flexibility in how we maintain our supply demand balance. Against our WRMP19 assumptions we are significantly under our forecast for outages planned and unplanned for this financial year (Strategic Grid 16.89 Ml/d outage planned and unplanned between vs 124.06 Ml/d WRMP Assumption). This has been driven in part through an increased focus on early indicators of unplanned outages and identification of new approaches to the way in which we carry out work.

The below table represents our outage data (Ml/d) since the beginning of the period since the ESoR began for the strategic grid resource zones. Our total outage has 3598.09 mega litres over 213 days which equates to 16.89 Ml/d.

Table 21 (Total Outage 1st April to 31st October 2022)

Outage	Groundwater	Surface water	Grand Total
Planned Outage	118.60	564.73	683.33
Unplanned Outage	1779.88	1134.88	2914.76
Grand Total	1898.48	1699.61	3598.09
Average ML per day of outage	**8.91**	**7.98**	**16.89**

As described in section 5.2, we took actions to reduce water treatment works output and preserve Derwent Valley raw water storage, this is largely due to reducing outages and ensuring our resources are used effectively. Our 22/23 forecast for Supply Demand Balance Index - level of service is yet to be finalised however we have maintained a steady state from our 21/22 position. This was a level of service of 100 (Reporting year DI scenario) with the Strategic Grid having 5.89% percentage surplus for the zone.

The below table lists the sources affected by outage both planned and unplanned since the beginning of the period since the ESoR began for the strategic grid resource zones.

Table 22 (Outages by site 1st April to 31st October 2022)

Site Name	# of outages	ML/d Lost Planned	ML/d Lost Unplanned	Total ML/d Outage	Average ML/d outage
Strategic Grid South East DBS 2	1		0.18	0.18	0.00
Strategic Grid South West BPS 1	13		27.68	27.68	0.13
Strategic Grid South West BPS 2	18		248.55	248.55	1.17
Strategic Grid South West WTW 1	18		107.10	107.10	0.50
Strategic Grid North west DSR 1	1				0.00
Strategic Grid South West (SS 1	32		3.93	3.93	0.02
Strategic Grid South West BPS 3	16		10.06	10.06	0.05

Strategic Grid South West WTW 2	19		181.35	181.35	0.85
Strategic Grid South West Gws 1	101		59.15	59.15	0.28
Strategic Grid South West BPS 4	23		39.53	39.53	0.19
Strategic Grid South West BPS 5	3		0.01	0.01	0.00
Strategic Grid South West BPS 6	12		3.22	3.22	0.02
Strategic Grid South West WTW 3	3		7.50	7.50	0.04
Strategic Grid South West WTW 4	30	7.10	18.70	25.80	0.12
Strategic Grid South West WTW 5	72		69.24	69.24	0.33
Strategic Grid South West Dbs 3	2				0.00
Strategic Grid South East WTW 6	4		25.28	25.28	0.12
Strategic Grid North East DBS 4	1				0.00
Strategic Grid North west DSR 2	1		0.00	0.00	0.00
Strategic Grid South West DSR 3	1		0.07	0.07	0.00
Strategic Grid South West WTW 7	69		14.52	14.52	0.07
Strategic Grid South East WTW 8	9	24.64	135.34	159.98	0.75
Strategic Grid North west BPS 7	80		13.32	13.32	0.06
Strategic Grid South West WTW 9	6		29.96	29.96	0.14
Strategic Grid South West BPS 8	5		1.29	1.29	0.01
Strategic Grid Central DSR 4	6		12.10	12.10	0.06
Strategic Grid Central DBS 5	2		0.05	0.05	0.00
Strategic Grid South West DBS 6	1				0.00
Strategic Grid Central DBS 7	10		39.38	39.38	0.18
Strategic Grid South West DSR 5	1				0.00
Strategic Grid South West DBS 8	1		0.04	0.04	0.00
Strategic Grid South West BPS 9	6		3.73	3.73	0.02
Strategic Grid South West BPS 10	4		2.21	2.21	0.01
Strategic Grid South West WTW 10	9		6.32	6.32	0.03
Strategic Grid Central GWS 2	1				0.00
Strategic Grid North west DSR 6	7		7.87	7.87	0.04
Strategic Grid North East WTW 11	19		456.17	456.17	2.14
Strategic Grid South West DBS 9	1		0.00	0.00	0.00
Strategic Grid South West DBS 10	1		0.02	0.02	0.00
Strategic Grid North East WTW 12	10		121.85	121.85	0.57
Strategic Grid South West WTW 13	43		60.33	60.33	0.28
Strategic Grid South East WTW 14	3		67.92	67.92	0.32
Strategic Grid South West BPS 11	8		16.40	16.40	0.08
Strategic Grid North west DBS 11	1				0.00
Strategic Grid South West Gws 3	37		11.82	11.82	0.06
Strategic Grid South West WTW 15	4		16.02	16.02	0.08
Strategic Grid South West BPS 12	3		4.70	4.70	0.02
Strategic Grid South West WTW 16	4		34.76	34.76	0.16
Strategic Grid South West DBS 12	1				0.00
Strategic Grid South West BPS 13	27		17.15	17.15	0.08
Strategic Grid South West BPS 14	13	65.29	8.36	73.64	0.35
Strategic Grid South West DSR 7	3		17.29	17.29	0.08

Strategic Grid North East WTW 17	9		67.21	67.21	0.32
Strategic Grid South West DBS 13	1				0.00
Strategic Grid South West BPS 15	4		0.67	0.67	0.00
Strategic Grid South West DBS 14	1				0.00
Strategic Grid South West DBS 15	1				0.00
Strategic Grid South West WTW 18	13	237.87	218.67	456.54	2.14
Strategic Grid South West DBS 16	1				0.00
Strategic Grid South West BPS 16	13		354.88	354.88	1.67
Strategic Grid South West BPS 17	9		13.21	13.21	0.06
Strategic Grid North west WTW 19	4		24.13	24.13	0.11
Strategic Grid South West DBS 17	1		0.06	0.06	0.00
Strategic Grid South West BPS 18	8		1.59	1.59	0.01
Strategic Grid South West BPS 19	25		15.89	15.89	0.07
Strategic Grid South West WTW 20	6		3.69	3.69	0.02
Strategic Grid South West BPS 20	5	46.22		46.22	0.22
Strategic Grid South West BPS 21	23	302.22	280.85	583.07	2.74
Strategic Grid Central WTW 21	2		14.25	14.25	0.07
Strategic Grid South West BPS 22	24		19.25	19.25	0.09
Strategic Grid South West DBS 18	2				0.00
Strategic Grid South West Dsr 8	1				0.00
Total	**920**	**683.33**	**2914.76**	**3598.09**	**16.89**

In relation to our Strategic Grid North area, there was one significant unplanned outage which ran from the 16th until the 29th of June, at this time a works (shown on the table above as Strategic Grid North-East 1 (WTW)) was restricted 20 Ml/d for 12 days due to a failure of a Non-Return valve. This works utilised water from Meerbrook Sough. During this period, our Upper Derwent Water Treatment works averaged 143 Ml/d to reduce the risk of customer outages whilst balancing abstraction on the Derwent and not increasing the works to its full output 176 Ml/d.

7.2 Applying learnings from past events

Applying our learnings from the 2018 Hot Weather and "Beast from the East", we have invested in several areas to improve our resilience which has enabled us to reduce demands on Derwent Valley. From 2018 to 2021 we have invested over £5m across on several activities that looked to increase deployable outputs from groundwater sources in vulnerable areas, remove network restrictions an enable greater flexibility, and reduce our risk of unexpected asset failure. Examples of these activities are:

- Installing Variable Speed Drives across Nottinghamshire to enable better control of water transfer in the water resource zone, requiring less reliance on the Strategic Grid.
- Installation of telemetry and additional sample points to provide better control of production and allow sustained peak deployable output from our water treatment works that take off our Cropston and Swithland reservoirs.
- Returning assets to service on a water treatment works on the lower Derwent to provide improved resilience against deterioration in clarified water quality.

Indirectly, one of the areas our strategic grid can support is Nottinghamshire, following the learnings of the 2021 hot weather we have also invested to reduce outage in this area and minimise strategic grid exports to this area. Over the past year we have:

- Completed capital maintenance, refurbishing seven boreholes and a further two treatment plants across multiple sites to sustain deployable output and increase resilience.
- Installed generators on standby across multiple sites to reduce outages due to power.
- Launched a new standby rota for better resilience in event of an outage.
- Completed a proactive maintenance regime ahead of disinfection equipment.
- Optimised the network further for stability.

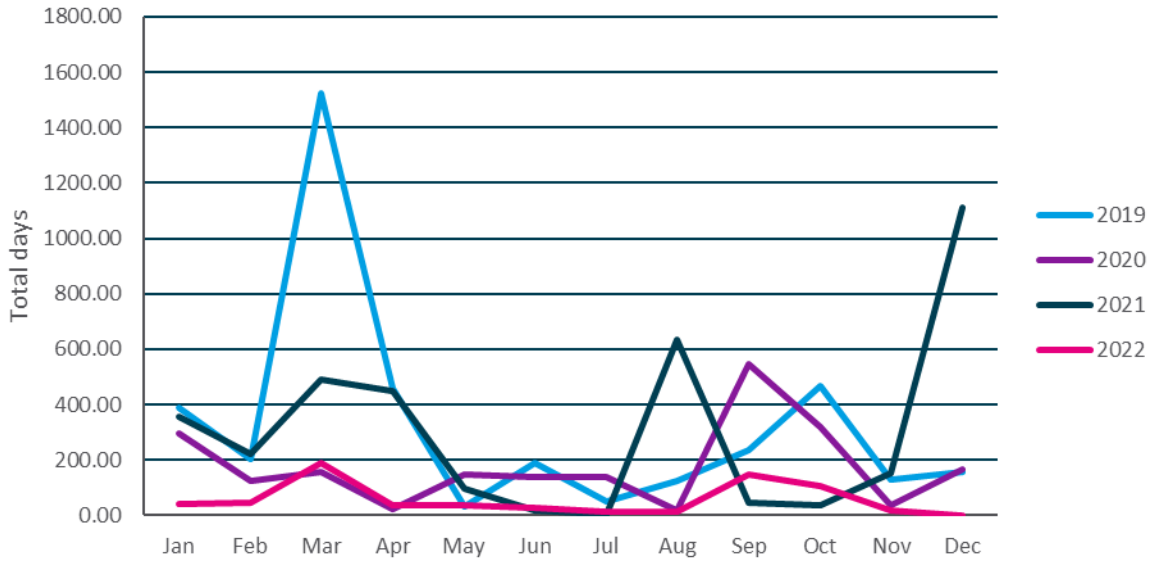
7.3 Responding to drought conditions

In response to Drought conditions, we have implemented several activities through the summer of 2022 to help reduce abstraction from the northern part of our strategic grid water resource zone. Examples of these activities are:

- Improvements to asset condition and availability at a Water Treatment Works that abstracts from the lower Derwent and investing in additional monitoring to increase through-put by 10 Ml/d. These new operating levels required the release of additional water from Carsington into the Derwent to enable the increased level of abstraction but has protected resources would ordinarily come from Derwent Valley reservoirs.
- We invested an additional £1m at another water treatment works that abstracts from the Derwent in Derbyshire to improve resilience ahead of the summer to sustain higher output from the works whilst maintaining water that is good to drink for our customers.
- We have improved process control mechanisms at Water Treatment Works which enabled us to improve output, resilience and flexibility between Derbyshire, Nottinghamshire and supporting the strategic grid from our reservoirs at Ogston.
- We have been working with the EA and Coal Authorities to reduce discharges containing bromide into the Derwent. As a result, there hasn't been a water quality related challenge this summer, which could have resulted in outage of our works.
- We also evaluated our capital programme for opportunities. As an example, a borehole in the peak district was taken out of service in late 2021 for planned capital maintenance and routine tank inspections. Follow on work was identified as a result of the planned activities with the programme of work expected to be completed after the summer months. In response to the hot and dry weather, a 'fast track' plan was implemented to complete the required remedial work and recommission the site over a 4-day period.

In line with our drought plan, we have ensured we maximise our resources available wherever possible, to achieve this we decided in April to reduce the number of planned interventions (outages) at non-infrastructure sites that impact the strategic grid. As a result of this, the number days we have had assets out between April and September in 2022 has been 75% less than the average between 2019 and 2021, this can be seen in Figure 28 (Total Intervention Days Scheduled per Month for sites impacting Strategic Grid North-East, South-East and South-West).

Figure 28 (Total Intervention Days Scheduled per Month for sites impacting Strategic Grid North-East, South-East and South-West)



8. Customer engagement

8.1. Our communications have raised awareness about the situation

During the summer period leading when demand was high we launched our largest ever customer engagement programme this summer investing more than £1M on campaigns across TV, radio, social media, outdoor posters, text messages, PR and digital advertising to inspire efficient water use, and to offer customers simple water saving tips they could follow.

In the last two years we have increasingly relied on behavioural sciences:

- Professor Ivo Vlaev and the Behavioural Sciences Group at Warwick University helped design our summer SMS alert system and wider summer engagement.
- We tested customer responses to different stimuli through our online community.
- Undertook trials to understand what drivers have the most impact.
- Professor Lucy Easthope advised our Board and Executive this summer on how to engage with customers in a post-COVID world so that we have the greatest long-term impact.

This work has shaped how we have engaged with customers, for example:

- Focus on financial motivations which have had the largest impact in changing water behaviour.
- Avoid telling customers what they can and can't do and instead provide more practical support (e.g., don't tell customers to stop using paddling pools, instead encourage them to refill less).
- Ensuring our messages support long term behavioural change so we can mitigate climate impacts (e.g., ensuring each piece of engagement is additive).

Our summer campaigns were seen or heard over 115 million times, and we are planning to sustain elements of the campaign throughout the winter period and into the spring. The contents of our campaign were designed around the different socio-economic factors and context at the time. The desired outcome was to raise awareness and encourage efficient water use and leakage reporting.

Our summer campaigns were seen or heard over 115m times	
1.6 m all-customer emails	9.5m SMS
Local media campaigns	Local radio broadcasts to 13.8m people
Leveraged social influencers	Tailored call centre wait music
Reminders to all our employees	Emailed our suppliers
Reached 88k customers in specific regions via social media boosts	Commonwealth Games – ½m interacted with our water saving messages

Targeted Audio

We used the same creative as summer 2021 as we found that these ads were the most effective with the demographics via targeted audio. This activity was live from 6th June to 21st July and targeted all adults in Nottingham, Wolverhampton, Staffordshire and Telford. During the campaign period the ads received 1,171,827 impressions, with the highest engagement occurring between the 13th to 19th June. All creatives had a very even split of interaction/engagement. The ads focused on giving customers water saving tips to change their behaviours.

Radio

This year we also wanted to add in an incident ad to be more instructive and bring us in line with the wider industry. This went live on the 28th July and ran for four weeks (until 24th August) reaching 50% of adults across our region. The radio ad achieved 14,688,186 impacts and was played across a range of Free, Hits and Heart radio stations across the region. This ad focused on the challenge of keeping up with supply and providing customers with tips for saving water.

Social Media

As part of our communication plan, we have utilised targeted social adverts to areas where demand has been the highest in our region. These ran from 6th June to 17th July.

Hedgehog

Frog

The Hedgehog & Frog ad were visible to the under 35 population across Nottinghamshire, Staffordshire, Telford and Wolverhampton. These ads lead to their own landing page which can be found here: stwater.co.uk/careforit.

Sprinkler

Bucket

The Sprinkler and Bucket were visible to the over 35 population across the above targeted areas. The Sprinkler & Bucket ad leads to their own landing page so we can monitor uptake: stwater.co.uk/lookafterit.

After publishing these social media adverts, we found that:

- All four ads received 2,914,035 impressions and a 0.37% click through rate. With ads mostly being viewed on smartphones.
- All ads received similar engagement, with Sprinkler being the front runner with 293,110 impressions alone.

We've posted 26 organic social posts across all regions, utilising Facebook, Instagram and Twitter. With interaction on Twitter and Facebook being the highest.

Utilised boosted social in North Staffordshire, Forest & Stroud. This ran from 11th to 25th July and received a total of 17,481 engagements. Derbyshire boosted social ran from 5th to 26th August and received 19,927 engagements.

Working with influencers

We utilised six influencers across June and July and had a total of seven posts. They have a combined following of 146,856. Diary of the Denton Dolls was the best performing ad, receiving 1,316 likes and 49 comments. Most comments were very positive, people were really engaged and offered their own water saving tips.

SMS

In total 7,380,319 SMS were sent @ a cost of 3.8p = £280,452.12. This was broken down into the following:

- **15th July** - sent 1,925,970 : *Hi, Severn Trent here. We're set for a hot weekend, and we need your help to make sure there's enough lovely water to keep your community hydrated. Do your bit by putting away the hoses and jet washers and turn off the tap when brushing your teeth. That way we'll keep the water flowing for all. Thanks.*
- **16th July -** sent 1,934,338: *Hi it's Severn Trent. The hot weather is here, and we want everyone to stay safe and hydrated. We are seeing a large increase in water use across the region. Please put the sprinklers and hosepipes away for a few days so we can keep the water flowing for all. Thanks, Severn Trent.*
- **29th July –** sent 1,590,631: *Hi, Severn Trent here. We just wanted to give you a massive shout out for helping us during the heat wave and this dry weather. All our teams are grateful for the effort as it is making a big difference. Thanks for your help this summer!*
- **11th August –** sent 1,929,380: *Hi, Severn Trent here, since we last spoke, we have not had any decent rain and experienced the driest July in over a century! With low rainfall and the sunshine here to stay, please stay hydrated and continue to use water wisely. Thank you.*

We also followed this up into September, as an example we sent this on the 14th September to all our customers:

Commonwealth Games

For 2022 we announced partnership with the Commonwealth Games to be their official Nature and Carbon Neutral Partner, our Brand was prominent with our water wise messaging conveyed at all venues, majority of which were situated within the Strategic Grid Water Resource Zone. The event attracted over a million people directly with millions more watching on TV. We saw this as a fantastic opportunity to promote our precious

resource and connect with customers directly on ways to not only be efficient with water they use but also other ways to protect our regions rivers and the broader environment.

For the duration of the games, we provided 41 water bars across 14 locations supported by 1000 staff volunteers.

8.2. We have worked with customers to try and reduce their demand for water

Leakage

Since 2021 we have been using leak alarm data from our meters, proactively targeting customers that had a continuous flow at the property. We offered to check the water fittings at the property, installed water saving devices where appropriate and carried out simple plumbing repairs where it was simple to do so – this is free of charge to the customer.

We quantified the leak before and after the repair and used this to confirm actual water savings. This programme has been very successful, having delivered 1.21 Ml/d savings and 4,542 Water Efficiency audits for 2021/22.

Our programmes have been highly successful and has delivered 1.85 Ml/d of demand savings to date (including pre-2021). We are however, seeing fewer leak alarms as we work through the backlog but continue to develop additional workstreams to help customers reduce their demand. YTD for 22-23 (Apr-Oct) we have carried out 2,398 Leak alarm HWECs with a demand reduction benefit of 0.53Ml/d.

GWF (Get Water Fit) Leak repair challenge

The introduction of our bespoke 'Free leak repair' challenge on our Get Water Fit platform which highlights the benefit of a free leak repair. Customers can report leaks on their toilet, basin or shower and we repair them where possible or refer them to our Water Safe plumbers. Total Get Water Fit repairs completed YTD 22-23 (Apr-Oct) are 611 jobs for a total of 0.08 Ml/d demand benefit.

Vyn Leaky Loo programme

We have recently introduced a digital platform where customers can upload videos of their leaking toilet with an explanation of what the issue is. Our technicians then review the video's and repair the ones that are eligible under our free fix offer and offer advice to those which are not. Initially the programme will be targeting new build properties as data suggest these are more likely to have leaking toilets. We emailed c.30k customers in August talking about leaky loos and encouraging customers to get them fixed through this programme. We have delivered 53 leaky loo repairs as a result of this campaign for a benefit of 0.03 Ml/d.

We have also utilised Vyn as part of our Demand Management campaign in Leicestershire and Derbyshire. We have recruited Community Water Saving Champions (CWSC's) to engage customers face to face through door knocking and community events, The CWSC's are promoting vyn through conversations and leaving leaflets with all customers to self-serve in reporting their leaky loo, shower or tap via Vyn. This is passed onto our contractor PNDaly to triage and repair the leaks. Through this workstream we have had a total of 133 vyn submissions (Oct) and 45 jobs completed at a saving of 0.016 Ml/d (360l per job).

Consumption Team HWEC's

We are currently trialling home water efficiency checks with customers who have come through our retail channel due to a high bill. In the current reporting year, we have completed 389 HWECs (Home Water Efficiency Checks) with these customers and so far, have seen a demand saving of 0.22 Ml/d.

Meter Reader HWEC's

Our Severn Trent Meter Reader teams carry offer some Home Water Efficiency Checks to customers where they attend a property with a high consumption reading. YTD the metering team has delivered 2,292 HWECs for 0.096 Ml/d benefit.

Highest Consumers

To understand why our top 4,000 customers are using excess water we are looking to understand reasons for continuous high usage i.e. high occupancy, internal plumbing losses, behaviours, and opportunities to help them reduce their water consumption and We will be offering them a free Home Water Efficiency audit and leak repairs on internal plumbing. We have delivered a series of e-mail campaigns to high users over the course of the financial year with the offer of a Home Water Efficiency Check (HWEC). Year to date we have delivered 670 HWECs at a total saving of 0.06 Ml/d.

In addition to BAU activity we have also targeted the top 30,000 highest customers in Leicestershire and Derbyshire with a highest user e-mail campaign offering a free Home Water Efficiency Check. This took place in October and generated a total of 512 customers signing up, with 250 HWECs completed to date. Total savings delivered so far is 0.017 Ml/d with an average saving of 68 litres per job.

Higher Than Average Consumers

To understand how some of our higher-than-average use customers are using water we are looking to understand reasons i.e., internal plumbing losses, behaviours, and opportunities to help them reduce their water consumption. We have offered a number of customers a free Home Water Efficiency Check and leak repairs on internal plumbing as a trial. Year to date we have delivered 83 jobs at 0.005 Ml/d savings.

Social Housing Home Water Efficiency Checks

We have a commitment to support customers residing in Housing Association accommodation with the offer of a free Home Water Efficiency Check. Year to date we have delivered 673 Social Housing HWECs with a total benefit of 0.03 Ml/d.

Smart Metering HWEC's

Within the Coventry Smart Metering area we have offered customers with a low-medium continuous flow alarm a Home Water Efficiency Check. Year to date we have completed 104 jobs at 0.01 Ml/d benefit.

Community Engagement

We also work with teams across Severn Trent in customer facing roles to deliver water efficiency advice and to promote our other water efficiency offerings such as products and home water efficiency checks. We have expanded the number of teams we work with and developed our existing relationships to ensure that water efficiency remains a key message across the business.

Gardening industry

We have partnered with the Wildlife trust and Plant Life on social campaigns discussing the impact on the environment and saving water as well as promoting our own Gardeners Growing Kit.

Water industry

We have run two social campaigns supporting Water Wise and Water UK – we mirrored their messaging and also referenced their research in some of our comms.

NHH retailers

We have shared our comms with the NHH team to ensure we are aligned in our messaging. There are regular meetings with the NHH WE team to continue communication.

Media briefings

We've held various media briefings over the summer to talk about the hot weather and low rainfall.

- **Tuesday 9th July –** interviews with BBC Radio Gloucester, BBC Radio Hereford & Worcester, BBC Shropshire, Bauer Media Group and BBC West Midlands.
- **Wednesday 10th July** - interview with BBC Radio Leicester.
- **Friday 15th July** Media Day at Carsington Water – interviews with BBC Midlands Today, ITV Central News, Global Radio (inc. Heart, Capital, LBC and Smooth radio), Greatest Hits Radio, Harborough FM, BBC CWR, BBC East Midlands Today, BBC Radio Nottingham, and BBC Radio Stoke.
- **Monday 8th August** – interview with Heart FM.
- **Tuesday 9th / Wednesday 10th August** - Radio media day: BBC Radio Gloucester, BBC Radio Hereford & Worcester, BBC Radio Shropshire, BBC WM, BBC Radio Leicester, Bauer Media
- **Thursday 22nd September** – Interviews to promote the save water/save money message BBC Radio Derby, BBC Radio Leicester
- **Thursday 29th September** – interview with BBC WM
- **Monday 3rd October** – Media day at UDV: BBC East Midlands Today, ITV Calendar News, BBC Radio Sheffield
- **Wednesday 19th October** – BBC Radio Stoke interview on UDV drought permit

Free and subsidised products

We continue to offer free water saving products on request to our customers which we promote via our digital platform called Get Water Fit. The platform provides customers with all the tools they need to save water, energy, and money, while also supporting local charities and schools. By answering a few simple questions about their water usage habits and appliances, customers can compare their water use to others and find out which free water-saving products are suitable for their home.

By completing the Get Water Fit calculator, which takes around five minutes, customers can order appropriated free water saving devices. Plus, any completed water saving challenges will be turned into rewards in the form of coins which customers can then donate to a charity or school of their choice. We contribute a £1000 which is allocated and distributed across (up to nine charities/groups) in % proportion to the coins earned over a period of six months. Our partners Save Water Save Money (SWSM) facilitate email communications to remind customers of outstanding challenges not yet complete and/or outstanding coins not yet donated, this is to motivate users to support their charity/group. We have seen the number of customers registering (completing the online calculator) on the Get Water Fit platform double between the months of April-August 2022, compared to the same reporting period of 2021. We have had 64,001 registrations this reporting year (Apr-Oct) with 0.77 Ml/d saving which has already exceeded our overall annual total target of 37,383 registrations (0.4 Ml/d).

We have also utilised Get Water Fit as part of our Demand Management campaign in Leicestershire and Derbyshire. We have recruited Community Water Saving Champions (CWSC's) to engage customers face to face through door knocking and community events, The CWSC's are promoting Get Water Fit through conversations and leaving leaflets with all customers to self-serve. This has delivered an additional 829 customers registered to the website with a benefit of 8,870 litre savings (0.009 Ml/d).

Our three-month campaign at the beginning of June 2021 was launched through our 'Be a water saving hero' to help customers use water more wisely. Throughout the campaign, we offered our water saving customers the opportunity to win a day out. Customers needed to upload a photo, video, or drawing/design of their top tip to Facebook or Instagram and explain the idea or top tip in the description. They were entered into a free prize draw to win a £200 gift card for use in a variety of restaurants, theme parks and hotels. They were also entered into a draw for Commonwealth Games tickets to help with engagement and reinforce water saving behaviour messages.

Our communication and marketing team continue to push the promotion of both free and subsidised products and have delivered 7 successful email campaigns that has reached more than 1.5 million customers this year.

We have had a total of 153,909 product orders year to date via the website, this has that has already delivered and assumed 1.24 Ml/d of demand savings, we have already exceeded our annual target of 0.96 Ml/d savings through water efficiency products.

We have also utilised Get Water Fit product orders as part of our Demand Management campaign in Leicestershire and Derbyshire. We have recruited Community Water Saving Champions (CWSC's) to engage customers face to face through door knocking and community events, The CWSC's are promoting Get Water Fit product orders through conversations and leaving leaflets with all customers to self-serve. This has delivered an additional 578 product orders in October with 7,000 litres saved (0.007 l/p/d).

Our free showerheads, swell gels and shower timers are some of the popular products that customers order. We've also two new products to our range; the Bubble stream tap aerator which has an inbuilt flow regulator, which helps customers to save on their water usage. It has a flow regulator of 8 litre per minute, compared to a standard 12 litre per minute flow rate. The second product is the toothy timer which encourages children to brush for two minutes and to turn off the tap between rinses.

We will continue to offer both pipe lagging and tap guards to help prevent pipe bursts on customer properties in the event of freezing weather over the winter period.

We offer subsidised water butts that have capacities of 100, 200 and 227 litres. Prices start from £30.21 for a 100-litre water butt which retails at £36.99, and we offer up to £10.00 off for the 200 and 227 litre water butts. The price includes a rain diverter kit and delivery. The Harcostar 227l Water Butt has been a success with customers which has plenty of capacity to keep gardens watered through extended dry spells.

We saw a record number of water butt sales for the month of August due to our ongoing engagement with radio stations throughout the region.

Our 8 litre regulated Methven showerheads are offered at just £8.50 against the recommended retail price of £30.00.

Summary of savings*

Dates	Activity	Savings (Ml/d)
April - Oct 2022	Leak alarms	1.21
April - Oct 2022	Get Water Fit leak challenge	0.084
April - Oct 2022	Consumption Team HWECs	0.22
April - Oct 2022	Highest User HWECs	0.06
April - Oct 2022	Higher Than Average HWECs	0.005
April - Oct 2022	Social Housing HWECs	0.03
April - Oct 2022	Smart Metering HWECs (Coventry only)	0.01
April - Oct 2022	Meter Reader HWECs	0.096
April - Oct2022	Get Water Fit registrations	0.77
April - Oct 2022	Free and subsidised products	1.24
Aug - 2022	Vyn Leaky Loos	0.03
TOTAL (22-23)		2.54

Demand Workstream (Leicester & Derbyshire only)

Dates	Activity	Savings Ml/d
Oct-22	Vyn Leaky Loo HWECs	0.017
Oct-22	Highest User HWECs	0.017

Oct-22	Meter Reader HWECs	0.093
Oct-22	Get Water Fit registrations	0.009
Oct-22	Free and subsidised products	0.007
TOTAL		0.143

*This includes savings attributed to customer emails and social media.

8.3. We did not implemented a temporary use ban

The legislation (Water Industry Act 1991, as amended in the Water Use (Temporary Use Bans) Order 2010) allows that temporary use bans (TUBs) can be used if a serious deficiency of water available for distribution exists or is threatened. Our Drought Plan explains that if extended drought conditions mean that reservoir storage or other drought indicators are in drought trigger level 2 during the spring and summer, we may need to temporarily restrict certain uses of water. Temporary use bans (TUBs) apply to domestic customers preventing use of hose pipes for recreational and cleaning purposes.

Within our Drought Plan we refer to such measures being considered in spring and summer nominally April through October when outdoor water use is more prevalent, and restrictions will materially reduce demand on our water system. It is unlikely these restrictions are applied in autumn and winter as external water use is much less and therefore restrictions of this nature do not materially alter demand.

8.4. We are trialling new methods of engaging our customers

The water industry currently has no accepted drought related intervention plan for demand over the autumn and winter period. Having determined that a TUB would not address the demand pressures on our system at this time, we have developed the first mass campaign designed to tackle in home usage. We recognise this approach is not currently prescribed within our drought plan albeit we strongly believe this is the right course of action for our customers and the environment. We have been deliberate in setting up a multifaceted approach incorporating different media outlets alongside face to face and in home activities. We are committed to sharing our approach and learning with our stakeholders and with wider sector as this could form a blueprint for future drought recovery and climate change adaptation.

We have used independent behavioural scientists and media agencies to develop our approach. Our eight million customers will each have c25 interactions with our activity during the three to four month period. The table below sets out the channels we have live and expected reach.

Table 23 (Overview of our communication channels and reach)

Channel	Forecast Reach	Reach to date	Live Status
Radio	97.1m reach	42.6m	Live
Press/ Media	79m reach	106m	Live
40 community pop-up events	10k reach	3k reach	Live
Work with retailers & NAVs to engage their customers	>30 retailers & NAVs	>30 retailers & NAVs	Live
Text messaging	1.9m customers	1.9m customers	Live
Emails	1.6m customers	1.6m customers	Live
Third-party engagement	CAB, CCWater etc	CAB, CCWater etc	Live

Social influencers	290k	290k exp	30th Nov
71 school education visits	18k children	22k children	Live
Social media boost	40k reach	231k	Live
TV and VoD ad	19.9m reach	19.9m exp	Live
Total	**199,858,030**	**172,315,030**	**Diff: 27,543,000**

We are using wide-ranging media as part of the arsenal. A new TV ad – borrowing from the hugely successful Starbucks Glen ad that played a catchy 80s tune while following Glen through his day, supported by Starbucks (found https://www.youtube.com/watch?v=8oXNmNUeoE4).

Our ad also aims to use humour to help our message to cut through to our audience and drive behaviour change. It aims to bring joy to saving and will follow an individual/ family around their house in the morning showing all the ways to save water and money.

We have taken a layered approach to our marketing campaign to make sure it has maximum impact. We know from previous activity and behavioural change insight that a mix of channels works best. Press, TV and radio work to build awareness with customers around the subject of saving water and how precious it is. Building this awareness means that when we follow up with more direct messaging, customers already have a baseline understanding so are more likely to make a change. We'll also use SMS, email and social media to provide more information and give a clear instruction to customers to do something different. We can also use these channels to promote products or our Get Water Fit app to which we can attribute demand savings. In addition, using more than one channel means customers are likely to hear the message more than once which is again important to drive behavioural change.

We are also investing in additional resources to convey our message as well, recruiting circa 40+ Community Water Saving Champions right now to support existing internal resource. We're partnering with local job centres and universities to match these opportunities to job seekers. Our Champions will take part in pop-up events across Derbyshire and Leicestershire at high-contact spots such as supermarkets, shopping centres, local attractions, in addition to visiting people's homes to carry out water efficiencies audits. We are aiming for 1000 visits per month. These are targeted in our highest demand areas of Leicestershire and Derbyshire which are the areas impacted by this permit. During these visits we will trial different information and products to gain as sense of customer preferences and impact.

Customers are responding well to our pop-up

How we'll measure the impact of customer visits

We have used industry wide data, for example from UKWIR, learning from other companies and data from our own demand management activities to forecast the demand savings from our activities. For example, we assume we will realise a 16 litre per property saving through having education conversations with customers physically in their home when we undertake Home Water Efficiency Check visits – this assumed benefit is quantified using the outputs of an UKWIR report which undertook research to quantify savings based on different types of interaction. Where, however, a customer does not have a physical face to face interaction with us and receive demand management education through our online get water fit platform we only assume 10.5l saving per property (again qualified using the UKWIR report) as we recognise this interaction is not so direct and therefore would not result in as much benefit. Where we physically install products, we use the quantification of the saving from that product to build into our demand saving assumptions. Where a customer orders a product online and is required to install it themselves, we have assumptions built into our model around the proportion of those customers who will install the product once received – these assumptions are based on Save Water Save Money's findings from research done across the water industry. Where a customer requests a free product that requires behaviour change or additional action, such as dye tablets to identify a leaky loo we do not assume any specific benefit in our demand saving.

When we repair an internal leak, we quantify the leak whilst undertaking the repair by undertaking a flow test before and after the repair. This is a physical demand reduction change so is a sustained demand saving. We have used Waterwise data, wider industry data and data from our activity in Severn Trent to estimate the proportion of properties that are likely to have a leaking toilet. We know that properties built since the year 2000 are more prone to having a leaking toilet due to the type of product that was installed. We are targeting our door knocking activity in areas with properties built since the year 2000 to give us an increased chance of engaging customers with a leaking toilet and helping them repair them. Leaking toilets is one of the highest untapped opportunities in the home to help reduce demand. Our customer engagement activity has also focussed on customers who we know are higher users using actual consumption data.

Where we do not get a response from a customer and leave them a water efficiency leaflet, we do not assume this will deliver any specific benefit as it is too difficult to know whether a customer has or has not read it and taken any relevant action, but it still forms part of our proposition to ensure we can engage customers on the challenge. Therefore, we only classify a positive engagement where we have either engaged a customer face to

face through a home water efficiency check or where the customer has gone through our get water fit process, we do not classify the posting a leaflet through a customer's door as a positive engagement.

In our forecast calculations we have used actual data from previous campaigns to quantify things such as email open, response rates and uptake rates. These have been compared to wider industry data to ensure these are representative and realistic.

We will be using metering data, distribution input and DMA data to help validate the impact of our demand reduction engagement.

We had originally committed an additional £1 million on top of existing resources to deliver this activity; our current expenditure is tracking in excess of this.

Understanding our Customers Views

We have been running quantitative and qualitative customer research to understand customer views on TUBs and the current demand trial. We haven't had the full research output yet, however some initial findings have found:

1. **3/4 of customers surveyed agreed with the Severn Trent approach to increase proactive comms about water saving, rather than implementing a TUB.**
2. Customers mentioned they felt our SMS' were very positive stating that: *"[Severn Trent] contacted me to inform me of ways to manage my water usage given the recent hot weather"*
3. **Awareness of our summer ATL comms has risen for each of the last five quarters,** but it is the significant jump in direct comms awareness that stands out over the summer.
4. There **has been a huge spike in recall of water saving messages** – particularly via text message (with a new high in contact from Severn Trent via this channel).

The research used a representative sample of customers across our region, once we have the full research breakdown we will unpick attitudes towards the current drought situation, restrictions for customers and the link between water and energy usage in the home.

We will determine the level of support, or otherwise, for the approach we are taking. We will also be tracking the success of the demand trial in terms of customer recognition, feedback on customer communications and messages, campaign reach and claimed impact on household water consumption behaviours.

9. Managing the environmental impacts of the Drought Permit

We have carried out an environmental assessment of the likely effects of the drought permit, and this is described in the accompanying Environmental Report. The report assesses the potential environmental impact of temporarily increasing the annual abstraction licence for the combined abstraction from Staunton Harold and Foremark reservoirs. The effect of the proposed Drought Permit would be for less than one month during March 2023.

The assessment has focussed on the potential impacts of a change in reservoir drawdown and how that might affect the aquatic environment associated with the reservoirs. The compensation flow downstream of the reservoirs will remain unchanged and because the reservoirs are pumped storage, and designed not to spill, there would be no change to the flow regime downstream of the reservoirs.

Our report uses measured reservoir level data to predict hydrological impacts in Foremark and Staunton Harold reservoirs under baseline conditions and Drought Permit scenarios. The results of the hydrological analyses have been used to assess baseline data and predict potential impacts for the following pathways and receptors:

- Reservoir levels and shoreline exposure;
- Water Framework Directive status;
- Designated sites;
- Protected species;
- Water level sensitive species;
- Invasive non-native species;
- Site character; and
- Recreational users.

The conclusions are that for all receptors under the proposed Drought Permit, no impacts are predicted in comparison with the baseline scenario. To help make sure of this, we have committed to maximise pumping into the reservoirs while flows in the River Dove allow, to bring them back to normal storage levels.

More details of our approach and our conclusions can be found in the accompanying Environmental Statement.

10. Consequences of the Drought Permit application being rejected

The purpose of this permit is to allow us to continue abstracting an average of 230 ML/d from the Dove reservoirs up until 31st March 2023. Abstracting at this rate would exceed the licensed annual aggregate volume of 73,200 Ml by up to 3500Ml.

If this application is rejected, then at some point between 1st March and 31st March 2023 we will need to stop abstraction from the reservoirs until 1st April 2023. We do not have sufficient supply capacity in our system to offset this reduction in output from the Dove sources. As a consequence, we would be unable to meet the demand for water in our strategic grid water resource zone in this period. For context, the reduction in output that would be required to remain within the annual aggregate abstraction licence would be up to 230 Ml/d, which is the equivalent of the normal daily demand from around 1.6 million people.

Our recommendation is to grant this winter drought permit at the Dove reservoirs on the grounds that

- There has been an exceptional shortage of rainfall
- The effect of the permit is only for a short duration,
- It will preserve security of supply to customers,
- It will support the recovery of other reservoirs in our Strategic Grid zone, and
- It is unlikely to have any damaging environmental effects during the period it is in effect.

11. Consulting our key stakeholders

We have already consulted earlier this year with all stakeholders (and wider) as part of our drought plan review (2022-2027) and will now engage with them again on the Dove reservoirs winter drought permit option.

11.1. Consultation Process

As required by the March 2021 Drought permits and drought orders EA guidance, we are obliged to notify any navigation authorities and local drainage boards of our intent to apply for a permit. For the water courses affected by this drought permit application, we have not identified any navigation authorities or drainage boards.

11.2. Communication Plan

In parallel with submitting our application to the EA, we will:

- Contact statutory stakeholders (letter, notice and leaflet).
- Write letters to all other stakeholders (letter, notice letter and leaflet).
- Contact key stakeholders verbally prior to them receiving the letter.
- Discuss any concerns with stakeholders (with calls or face-to-face meetings if required).
- We will place formal notifications in the London Gazette and the Burton Mail
- The full application will be made available in locations in the affected area (as set out in the notice) for interested parties to view.
- Place a record of our application on our website, this will include the notice, the Justification of need and the Environmental Assessment report and covering document.
- We have separately contacted Natural England

11.3. Engagement and communication strategy

We will contact all stakeholders to notify them of the intention to make the permit application, how we will protect against the potential impacts and how they can find out more about the permit we are applying for.

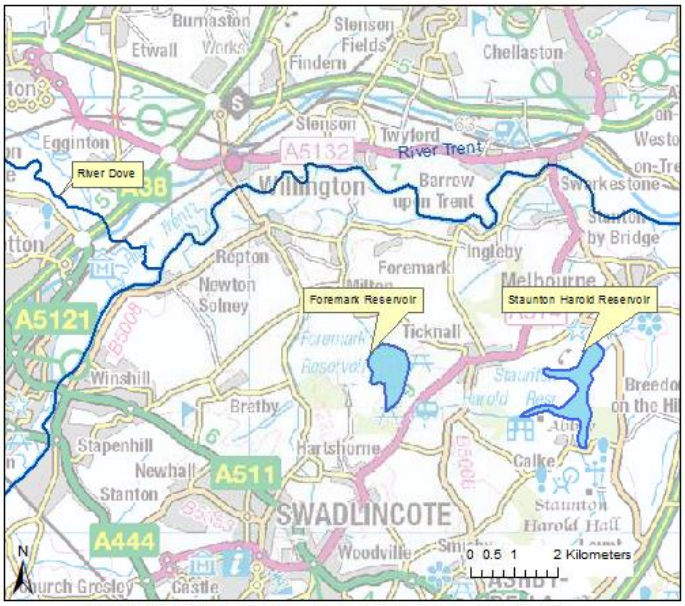
We have compiled a list of stakeholders utilising records of known downstream river users and feedback from local Environmental Agency teams alongside internet searches for local councils, MPs etc. Our stakeholders can be categorised into three areas: statutory, notifiable and community.

Our strategy for each stakeholder category is the following:

- **Statutory stakeholders**: We will contact statutory consultees in parallel with the application being advertised and notify them of why we are requesting the permit. We will offer to share a draft of the Justification of Need and Environmental Assessment Report for review.
- **Notifiable stakeholders**: We have worked with the Environment Agency (EA) to identify the downstream river users and abstractors who have the potential to be affected by the permit. We will write to them prior to the application being advertised, explaining the need for the permit, how we will protect against the potential impacts and options to contact us to find out more. We will also write to broader stakeholders including MPs and Councils.
- **Community stakeholders:** We will write to all identified community stakeholders in parallel with the application being advertised to notify them of the timing and need for the permit, how we will protect against the potential impacts and options to contact us to find out more about the permit we are applying for.

We will continue to keep stakeholders updated over the winter period as appropriate.

Figure 29 (Dove Reservoirs)



11.4. Media and Customer

As set out in the guidance, we have put our notice into the London Gazette which will be published on 30th November 2022

We have also identified a daily local paper, the Burton Mail, with publication on the same date.

We also considered other publications; however, they covered over a wider area that it would not be relevant to this application. The Burton Mail is the main local daily newspaper that covers the correct area.

The notice and application will also be available on our website.

11.5. Location of Deposited Documents

Our application will be made available in the affected area for parties to view, free of charge, during normal working hours for a period of seven days from the publication of the notice:

- Swadlincote Library, Civic Way, Swadlincote, DE11 0AD, 01629 533013
- Staunton Harold Reservoir National Trust Café, Calke Road, Windmill Hill, Melbourne, Derby, DE73 8DN, 01332 865685
- Severn Trent Water, Raynesway, Derby, DE21 7JA,
- Environment Agency, Trentside Offices, Scarrington Road, West Bridgford, Nottingham, NG2 5BR, Tel: 03708 506 506
- Severn Trent Water, 2 St John's Street, Coventry, CV1 2LZ, Tel: 02477 715000
- Severn Trent Water's Website at https://www.stwater.co.uk/

Objections may be made in writing to the Environment Agency at Water Resources Permitting Support Centre, Environment Agency, Quadrant 2, 99 Parkway Avenue, Parkway Business Park, Sheffield, S9 4WF or psc-waterresources@environment-agency.gov.uk.

Objectors may also send a copy of their objection to the address below or by email to: FutureConsultation@severntrent.co.uk