DROUGHT PLAN 2022 APPENDIX

ESSEX&SUFFOLK WATER living water

EXCLUSIONS ON THE GROUNDS OF NATIONAL SECURITY

Northumbrian Water Limited has not excluded any information from this plan on the grounds that the information would be contrary to the interests of national security.

Under Section 37B(10)(b) of the Water Industry Act 1991, as amended by the Water Act 2003 (“the Act”), the Secretary of State can direct the company to exclude any information from the published Plan on the grounds that it appears to him that its publication would be contrary to the interests of national security.

DOCUMENT CONTROL SHEET

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Reviewed by	William Robinson	20/05/22	Water Resources & Supply Strategy Manager
Approved by	Keith Haslett	20/05/22	Water Director

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APPENDIX 1:
ESSEX DROUGHT VULNERABILITY ASSESSMENT

We are required to understand and demonstrate the resilience of our systems to a range of droughts. The UKWIR guidance (*Drought Vulnerability Framework*, 2017) provides an approach that water companies can use to improve the understanding of the vulnerability of their systems to drought and demonstrate this graphically by producing 'drought response surfaces' (DRS) for their water resources zones (WRZs).

The guidance recommends several different calculation approaches based on the data availability and the level of modelling available for each WRZ. These approaches are detailed in the table below.

Nature of Drought Rainfall Data and Hydrological Modelling	Nature of WRZ and Deployable Output Assessment	Approach Number	Notes/Comments
Stochastically based rainfall data (normally includes hydrological models, but can include multi-site flow generation)	Conjunctive with *rapid* simulator	1a	Where direct flow generation has been used then rainfall deficit/flow analysis required
	Conjunctive but *no* rapid simulator	1b	Uses a sample of the full stochastic data set ('drought libraries')
Synthetically based rainfall data	All	2	Requires Extreme Value Analysis (EVA) to estimate risk/return period
Historic rainfall data with rainfall/runoff and/or groundwater models	SW storage dominated (with behavioural model)	3a	Requires EVA of rainfall, and yield/return period behaviour
	Groundwater or run of river only	3b	Requires EVA of rainfall and flow/level return period behaviour
Historic rainfall data with no hydrological models	SW storage dominated (with behavioural model)	4a	Rainfall EVA and rainfall deficit/inflow relationships needed
	Groundwater or run of river only	4b	Rainfall EVA and rainfall deficit/level/flow relationships needed

Essex WRZ constitutes the 'Essex System', plus a surface water and two groundwater treatment works in South Essex. The Essex System represents the highly integrated network connecting the Essex rivers and their associated intakes, the pumped storage reservoirs at Abberton and Hanningfield, and the associated raw water transfer pipes, pumping stations and treatment works. The DI of the Essex System is around 80% of the total Essex WRZ DI. ESW have an Aquator model representing the Essex System, along with rainfall-runoff models for the rivers within the system.

On this basis, approach 3a is appropriate for carrying out this assessment for the Essex System. The calculation steps for approach 3a as set out in the UKWIR guidance are detailed here:

1. Carry out Extreme Value Analysis (EVA) to determine the probability of each deficit/duration cell.

2. Generate synthetic events (intensity & duration) using rainfall-runoff models for a selection of deficit/duration cells using the historic record.

3. Run the synthetic events through the behavioural model for the selected level of demand.

4. Calculate the number of days deficit for each synthetic event.

5. Compare the EVA plot of minimum levels or flows against the critical duration drought outputs, to scale the DRS inputs.

6. Plot DRS.

The resilience of the Essex System was assessed for the following drought durations and return periods:

Return Period/ Duration	100 yr	200 yr	500 yr	1000 yr
6 months	X	X	X	X
12 months	X	X	X	X
18 months	X	X	X	X
24 months	X	X	X	X
36 months	X	X	X	X

Selection of 'month end' of drought events

The guidance recommends that for a WRZ with a high level of storage driven by the annual average demand, the month end of the droughts is set three months apart. Historically the lowest storage levels experienced have been in October, and given the large amount of storage available within the WRZ the system is more vulnerable to a dry winter than a dry summer, therefore the month ending parameters have been set three months apart in October and December.

Level of demand used

The behavioural modelling is carried out for a single specified level of demand. The guidance suggests a few options, including:

- Total demand (DI)
- Total demand plus Target Headroom
- Total demand plus Target Headroom plus Outage
- Demand equivalent to DO

The guidance states that the primary analysis for regulatory returns should be run at DI plus Target Headroom. We therefore chose to run the analysis at this level of demand, using the actual DI and target headroom allowance for 2018/19, the most recent Dry Year affecting the Essex WRZ.

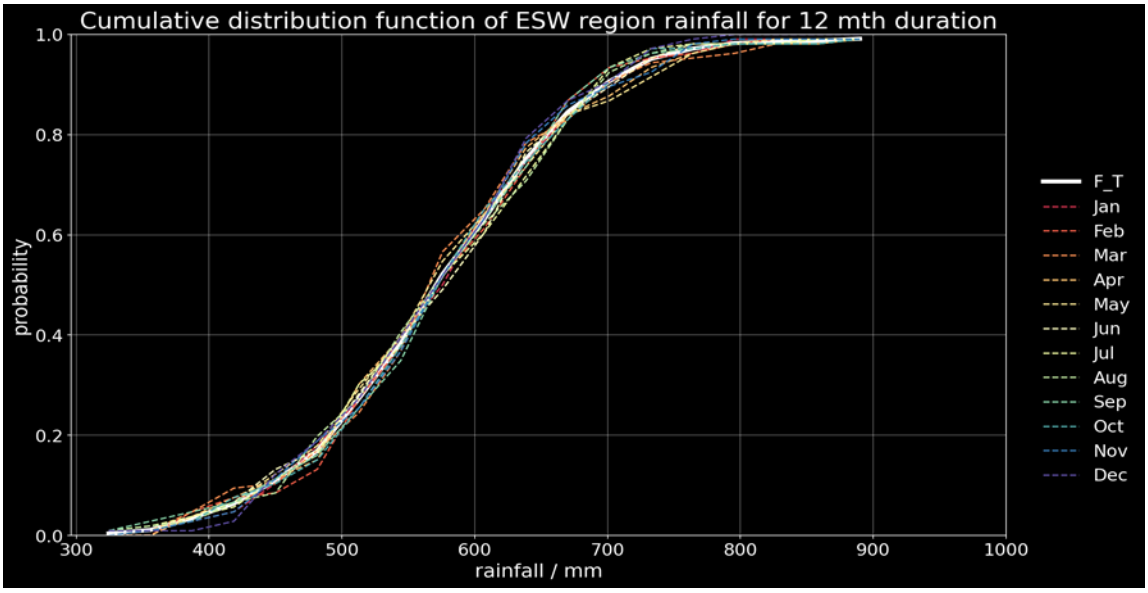
Rainfall data analysis

The rainfall datasets used for this study were originally derived from the CEH-GEAR gridded daily rainfall dataset. The rainfall series were averaged for all sub catchments to produce a single daily rainfall time series for the whole Essex System area, which was deemed an appropriate assumption given that the mean annual rainfall for each individual sub catchment lay within 5% of the regional mean.

The guidance requires rainfall frequency analysis for different drought durations to be based upon the same end-months as the selected drought end-month for the water resources system. Therefore, as October and December were deemed to be the critical end-months for reservoir drawdowns, rainfall analysis should be based upon the rainfall totals up to the end of October and December for every year of record.

To assess if the October and December end-month durations were representative of the population rainfall distribution, a Kolmogorov-Smirnov (K-S) test was carried out for all month ends, for each duration. This tests whether the rainfall totals for various durations at a given end-month are significantly different from the daily running 6-month rainfall total for the entire record, which was taken as the parent population distribution.

This assessment demonstrated that there is no significant difference between end-month rainfall totals for whole-year periods (figure 1a), therefore all whole-year period rainfall totals should be included in any assessment of frequency of occurrence, regardless of end-month. The situation for durations that include half-years is more complex, as there is a degree of seasonality demonstrated at this level (figure 1b). For the purpose of this study, the sampling regime was therefore extended to include month-end durations that were not significantly different from the central duration of interest.



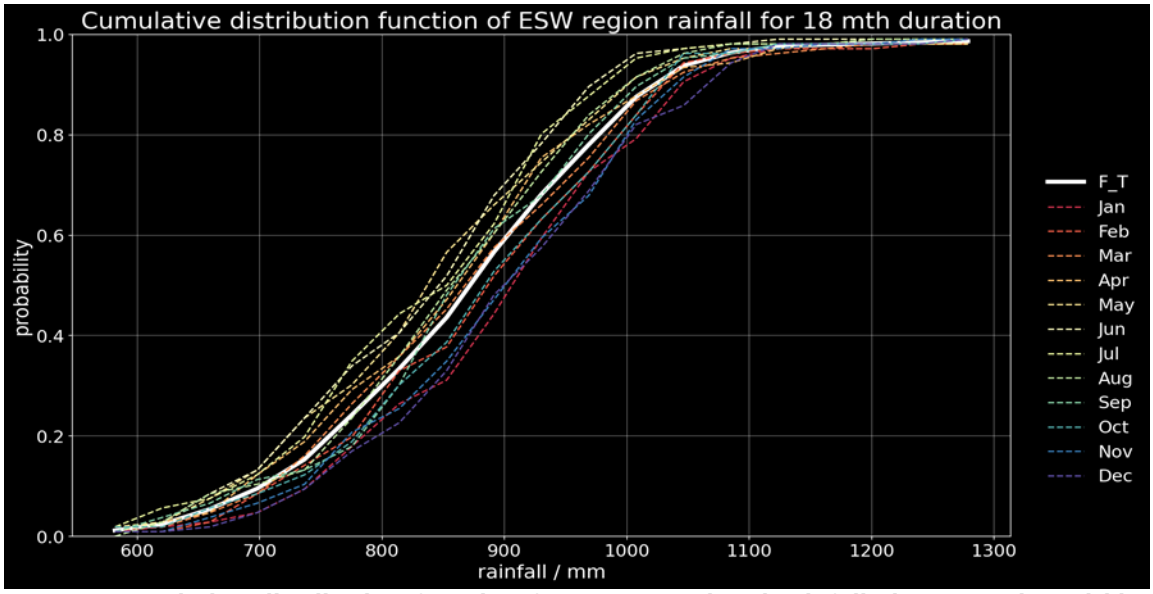


Figure 1: Cumulative distribution function for Essex regional rainfall a) 12-month and b) 18-month duration droughts for different month endings.

Rainfall series of various durations were tested against several extreme value distributions, and overall, they fitted best with a three-parameter GEV distribution. All rainfall depths were divided by the regional standard annual average rainfall (SAAR) for the period 1971-2000, to allow standardised rainfalls from each duration to be easily compared.

GEV factors were derived for the rainfall datasets as a ratio of the SAAR to calculate the rainfall required for each return period and duration. The resulting rainfall depths in mm for each duration and return period are presented in the table below.

Duration	6 months	12 months	18 months	24 months	36 months
1 in 100	119.7	342.1	561.6	827.6	1362.9
1 in 200	109.4	322.5	532.0	788.4	1311.9
1 in 500	97.7	301.8	504.6	746.6	1265.8
1 in 1000	90.4	285.1	489.7	740.2	1243.0

Creation of artificial drought rainfall sequences

Approach 3a requires the creation of artificial drought rainfall sequences, for use in rainfall-runoff modelling. In order to generate droughts with a realistic daily rainfall pattern, the guidance states that an existing historic year close to the average should be used. A rainfall year with a low monthly mean squared error (MSE) to the overall average monthly values, and with a mean close to SAAR, was selected to be the "warm-up" and "cool-down" year.

At least two “warm-up” years were attached before each drought event, and then four years of “cool down”. We have several 5-year rolling abstraction licences, which can hold the ‘memory’ of a drought in the licence utilisation total for an extended period. The long duration between drought events is necessary in order to avoid one drought impacting on the next. The droughts for each of the four return periods were stitched together to create a continuous time series containing all the drought events for each individual duration.

Rainfall sequences for each sub catchment rainfall-runoff model were then generated. The ratio of each sub catchment’s rainfall to the SAAR was calculated, and this factor was applied to the regional average to generate sub catchment artificial rainfalls for each drought length, return period and month-end.

Derivation of river flows

The generated rainfall sequences for each sub catchment were used as rainfall input to the rainfall-runoff models. The models also require an input for potential evapotranspiration (PET). After the artificial rainfall sequences had been created, the regional PET was matched from the entire record for each drought. PET values were left as regional averages across all catchments. Pycatchmod, a Cython implementation of a Catchmod rainfall-runoff model, was utilised to generate the flows for all catchments in the Essex System Aquator model.

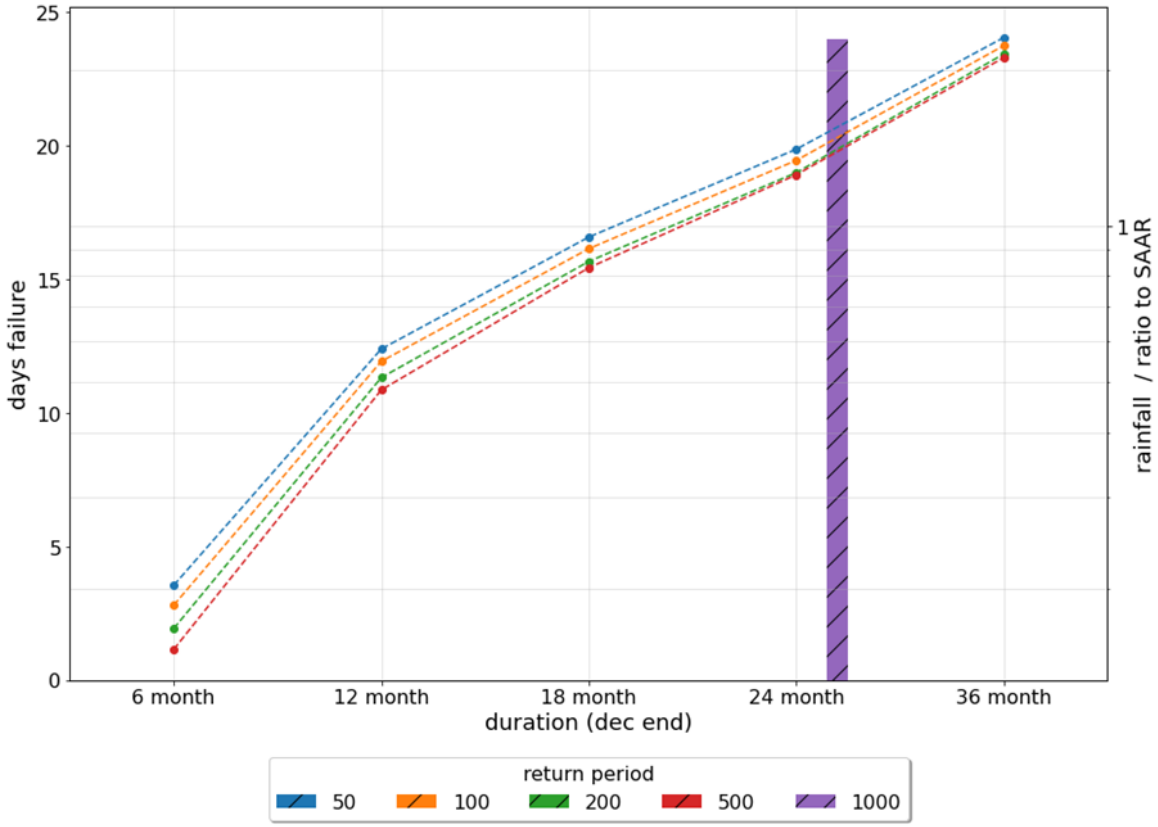
Aquator modelling

The drought scenarios were run through the Essex System Aquator XV model with demand set at 2018/19 DI plus Target Headroom allowance, and the number of days of failure of the system were recorded for each October- and December-ending drought. Failure occurred when the demand could not be met, or the emergency storage level of a reservoir was reached.

Only the December-ending 24-month 1000-year return period drought scenario caused failure (24 days).

Drought Response Surface

An alternative plot to the DRS in the form that it was recommended in the guidance is provided below, that we hope offers clarity whilst conveying the relevant information. This graph displays the number of days of failure on the left-hand axis as a bar chart, and the rainfall as a ratio of SAAR on the right-hand axis as a line plot. Drought durations are along the x-axis, with colours representing the different return periods.



We have now conducted a PR24 drought vulnerability assessment using the preferred stochastic modelling approach. The results will be presented in our draft Water Resources Management Plan to be submitted to Defra in August 2022.

APPENDIX 2:
GROUNDWATER DROUGHT VULNERABILITY ASSESSMENT

Regional Groundwater Modelling

To test the resilience of our groundwater sources to a 1 in 200 year drought, Amec Foster Wheeler (AFW), now Wood Plc, was employed to carry out groundwater modelling in PR19 using the Northern East Anglian Chalk (NEAC) and Essex regional groundwater models. Additional work for the Drought Plan has been completed to test the resilience of our groundwater sources to a 1 in 500 year drought (Wood, 2021).

The groundwater modelling carried out for the 1 in 500 year drought assessment was based closely on the previous 1 in 200 year assessment used for the PR19 Water Resources Management Plan (Amec Foster Wheeler, 2017). Six model runs were constructed – three for the North East Anglian Chalk (NEAC) groundwater model and three for the Essex groundwater model – representing the Naturalised, Recent Actual and Fully Licensed scenarios and running for a period of 1900-90 using stochastic rainfall and potential evapotranspiration.

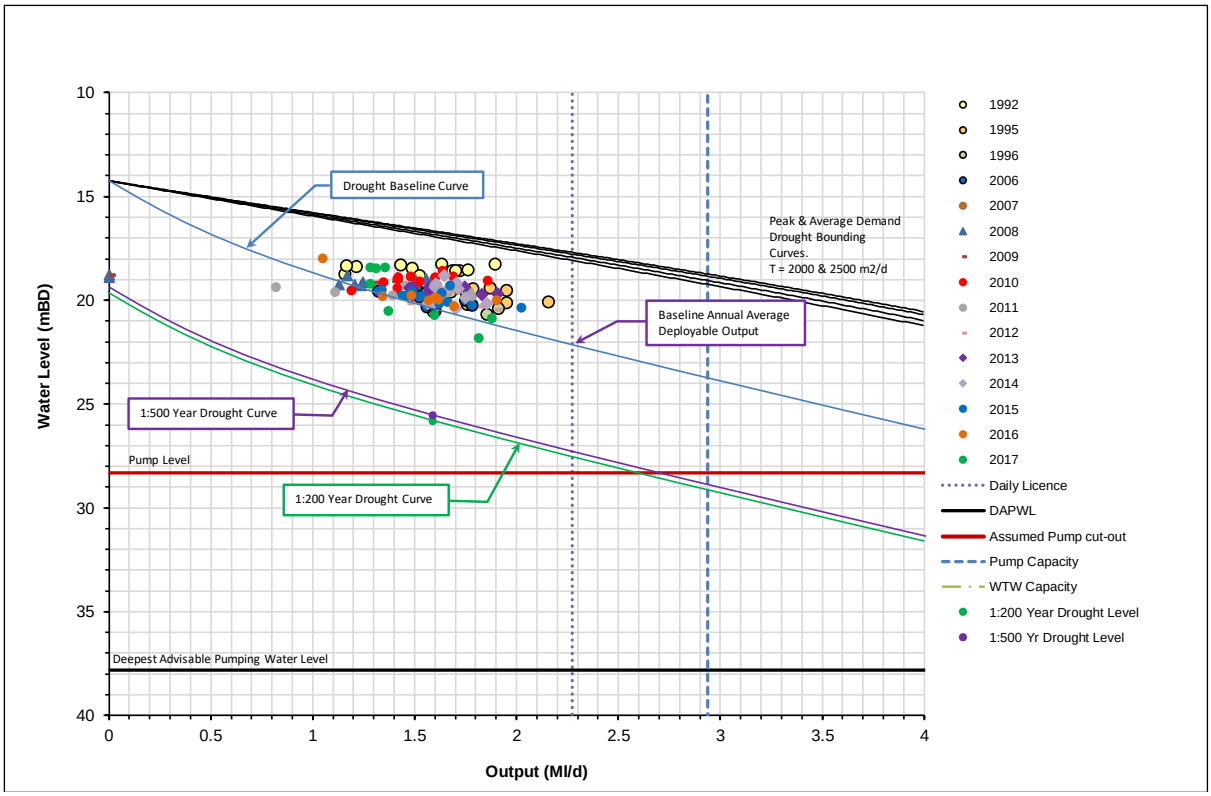
In all cases the hydraulic parameters and artificial influences were identical to those used for the equivalent 1 in 200 year scenarios, while rainfall and potential evapotranspiration (PE) data were derived from work carried out by Atkins (2020) on behalf of Water Resources East (WRE). Rainfall and PE timeseries for 1900-90 were provided for a series of locations across the two models, with each timeseries being assigned to that part of the model falling within the Voronoi polygon constructed from the locations of all the gauges. Output generated from these scenarios comprised groundwater levels and synthesised daily flows.

Further details of the 1 in 500 year groundwater modelling can be found in Wood's technical note (Wood, 2021).

Using Source Reliable Yield Assessment Graphs to Determine Deployable Output for Drought Scenarios

Modelled groundwater heads for all our groundwater sources were determined. For each groundwater source the lowest modelled historical water level experienced between 1970 and 2014 was compared with the lowest modelled 1 in 200 year and 1 in 500 year 24-month drought groundwater level during 1949 and 1950. The difference between these two groundwater level heads was then applied to the drought baseline curve for each groundwater source reliable output graph to determine whether there was likely to be a reduction in DO due to the two drought scenarios.

The following graph presents an example of how the drought baseline curve was adjusted for Blyth Borehole 3 to take into account the modelled change in groundwater level for a 1 in 200 year and 1 in 500 year drought event, to determine whether this would affect the DO of the source.



Results

From the groundwater modelling assessments all Essex and Suffolk groundwater sources were found to be resilient to a 1 in 200 year and a 1 in 500 year drought, with the exception of the South Essex wells.

The deployable outputs determined from the groundwater modelling and source reliable yield assessments are presented in the following table.

Table: Groundwater Deployable Output for Baseline, 1:200-year and 1:500-year droughts

Groundwater Source	PR19 Deployable Output (Ml/d)	1:200-yr Drought Scenario Deployable Output (Ml/d)	1:500-yr Drought Scenario Deployable Output (Ml/d)
Essex			
South Essex Well 1	3.50	3.50	3.45
South Essex Well 2	3.40	1.95	1.95
Colchester Borehole 1	1.93	1.93	1.93
Suffolk Blyth			
Blyth Borehole 1	3.17	3.17	3.17
Blyth Borehole 2	2.21	2.21	2.21
Blyth Borehole 3	2.27	2.27	2.27
Blyth Borehole 4	3.11	3.11	3.11
Blyth Borehole 5	0.29	0.29	0.29
Blyth Borehole 6	0.78	0.78	0.78
Blyth Borehole 7	2.85	2.85	2.85
Suffolk Hartismere			
Hartismere 1	0.548	0.548	0.548
Hartismere 2	0.63	0.63	0.63
Hartismere 3	0.45	0.45	0.45
Hartismere 4	0 (Emergency Use Only)		
Hartismere 5	3.02	3.02	3.02
Hartismere 6	1.25	1.25	1.25
Hartismere 7	2.749	2.749	2.749
Suffolk Northern Central			
Northern Central Borehole 1	7.12	7.12	7.12
Northern Central Borehole 2	3.41	3.41	3.41
Northern Central Borehole 3	2.00	2.00	2.00
Northern Central Borehole 4	2.356	2.356	2.356
Northern Central Borehole 5	0.47	0.47	0.47
Northern Central Borehole 6	1.35	1.35	1.35
Northern Central Borehole 7	1.51	1.51	1.51
Northern Central Borehole 8	0.54	0.54	0.54

1 in 200 year and 1 in 500 year Groundwater Modelling and Proposed Updates for the Revised Draft Drought Plan

The difference between the 1 in 200 year and 1 in 500 year drought scenarios was not significant, with no reduction in deployable output. The only exception was South Essex Well 1, which showed a reduction of 0.05 Ml/d between the 1 in 200 year and 1 in 500 year scenarios.

The same regional groundwater model version and a similar method was followed for the 1 in 200 year and 1 in 500 year drought scenarios. However, some of the model inputs and assumptions were not the same, therefore they are not directly comparable.

We will shortly be undertaking groundwater modelling for our Water Resources Management Plan 2024. This will use new 1 in 200 year drought and 1 in 500 year drought rainfall data from the new Met Office weather generator that has been developed for Water Resources East. The revised assessments will be included in the revised draft of this Drought Plan.

APPENDIX 3:
HOW WE HAVE TESTED OUR DROUGHT TRIGGERS

Overview

The Environment Agency's Drought Plan guidance requires that our Drought Plan be tested against a range of drought scenarios, to assess whether the drought actions and associated triggers ensure that planned levels of service are met.

Before completing this assessment, it is useful to:

i. Understand the return periods of previous droughts; and
ii. understand how previous droughts were managed. A summary for the droughts in the 1990s is presented in this Appendix.

The effectiveness of the Drought Plan is then considered against both the worst historic drought on record, and against a drought with a return period of 1 in 500 years.

Drought Plan Return Period Assessment

An assessment of the return period of the worst historic droughts in our record has been undertaken. These include the late-1990s drought for Suffolk and the early-1920s and early-1930s droughts for Essex.

The analysis has been undertaken following a methodology provided by the Environment Agency, based upon papers published by the National Climate Information Centre (Allen, 2012; n.d.) and in the Meteorological Office Scientific Paper No. 37 (Tabony, 1977).

Monthly rainfall totals for a 5 or 6 year period containing the known drought were obtained, and monthly long-term rainfall averages for the 1961-1990 period were calculated, as the 1961-1990 climatology is approximately 5% drier than for the 1981-2010 period (Allen, n.d.). A rainfall deficit for each month in the analysis period was calculated relative to the long-term average, and then summed to obtain a series of cumulative deficits.

Plotting the cumulative deficit series allows a window of analysis to be identified. An example for the late-1990s Suffolk drought is provided in the figure below, in which the plot suggests beginning the dry period analysis in October 1995.

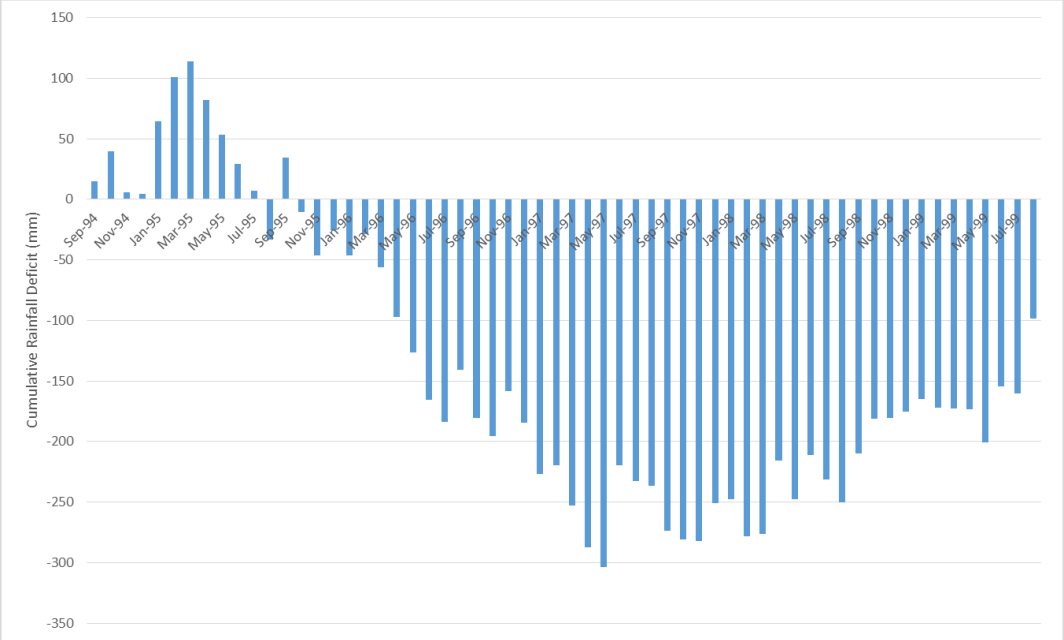


Figure 1: Monthly cumulative rainfall deficits for the late-1990s Suffolk drought

For dry periods lasting one month or more, it is suggested to use Tabony tables for extreme value analysis (Tabony, 1977). The cumulative rainfall and cumulative long-term average rainfall are calculated from October 1995 to the end of the analysis period, and the percentage of the cumulative rainfall in relation to the cumulative long-term average rainfall is calculated for each month. The Tabony table for the Anglian region, which identifies the percentage of long-term average rainfall corresponding to a given return period, was used to estimate a return period for a range of drought durations as illustrated in the table below.

Table 1: Tabony table for the Anglian region (Allen, n.d)

Return periods of dry spells	6 months	12 months	18 months	24 months	36 months	48 months
1 in 5	82	87	89	91	92	93
1 in 10	73	80	84	86	88	90
1 in 20	66	75	79	82	85	87
1 in 50	58	69	74	78	81	84
1 in 100	53	66	71	75	79	81
1 in 200	49	62	68	72	77	80

The return periods quoted in the table are determined from 1961-1990 long-term averages for areal averages of precipitation within the Anglian region, and the return periods are for rainfall of n-months duration starting in any month (Bader and Folland, 1977). Comprehensive uncertainties have not been determined for the return period estimates, but they will be high for the multi-century return periods, which should be viewed as indicative only. Therefore, the return periods are disaggregated into broad categories, and the tables do not specify return periods beyond 200 years (Allen, n.d.).

The results of this analysis are outlined below.

Suffolk: 1995-97 Drought

This drought is characterised by two dry winters, as illustrated in the rainfall deficit graph below.

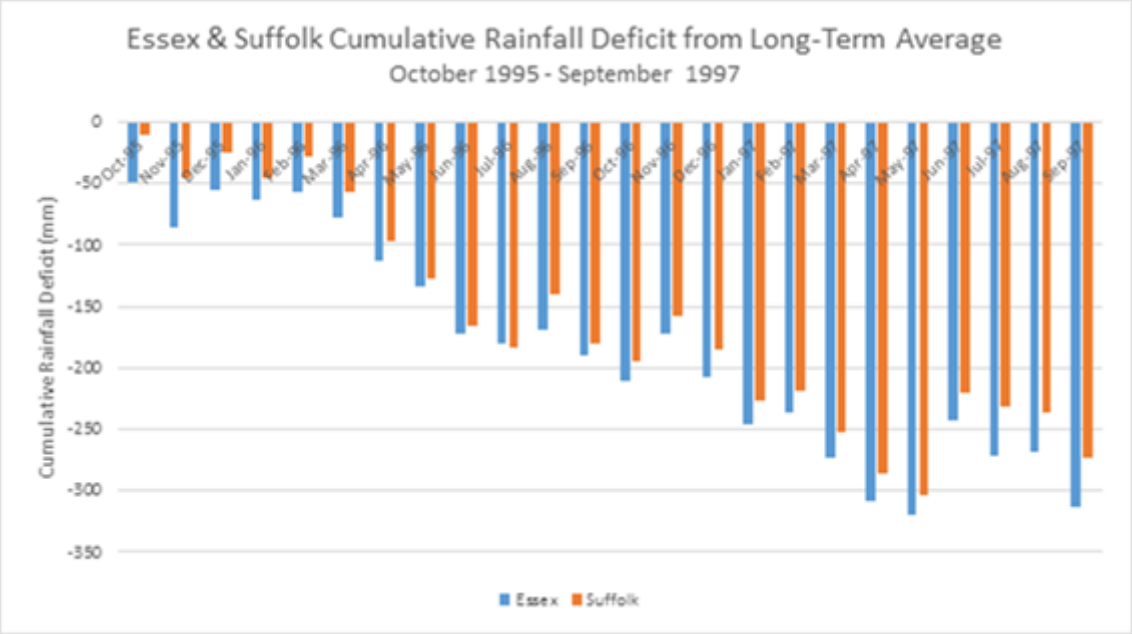


Figure 2: Monthly cumulative rainfall deficits for the late-1990s drought

Indicative return periods for durations of dry weather starting in October 1995 are summarised in the table below.

Table 2: Indicative return periods for durations of dry weather starting in October 1995

Duration	Return Period (years)
6 months	15
12 months	175
18 months	>200
24 months	165
36 months	15

Essex: Early-1920s drought

This drought is characterised by two dry winters, as illustrated in the rainfall deficit graph below.

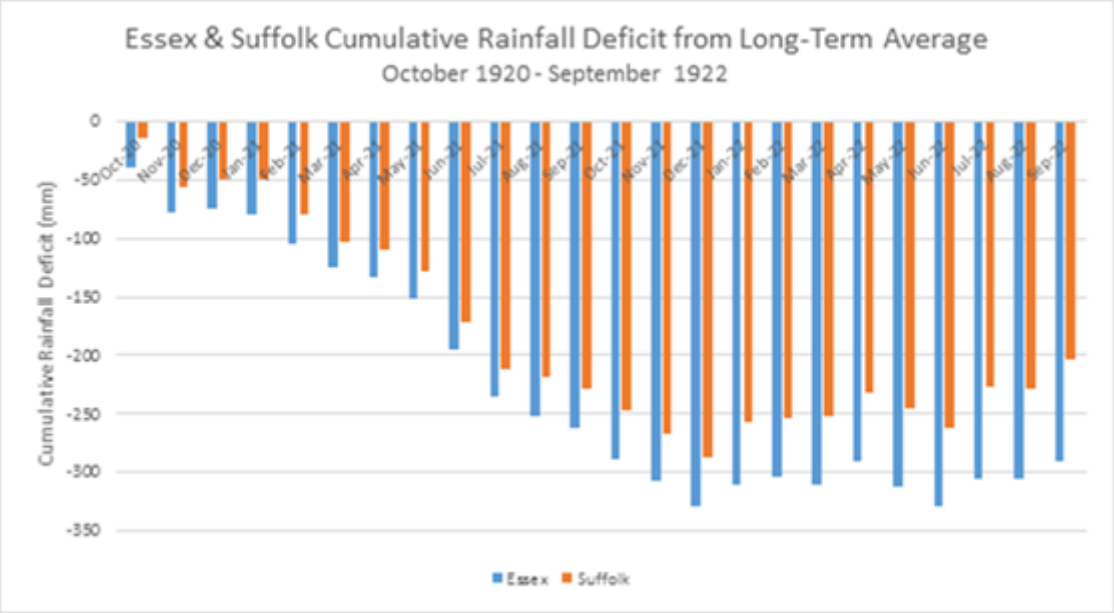


Figure 3: Monthly cumulative rainfall deficits for the early 1920s drought

Indicative return periods for durations of dry weather starting in October 1920 are summarised in the table below.

Table 3: Indicative return periods for durations of dry weather starting in October 1920

Duration	Return Period (years)
6 months	40
12 months	>200
18 months	>200
24 months	85
36 months	200

Essex: Early-1930s drought

This drought is characterised by two dry winters, as illustrated in the rainfall deficit graph below.

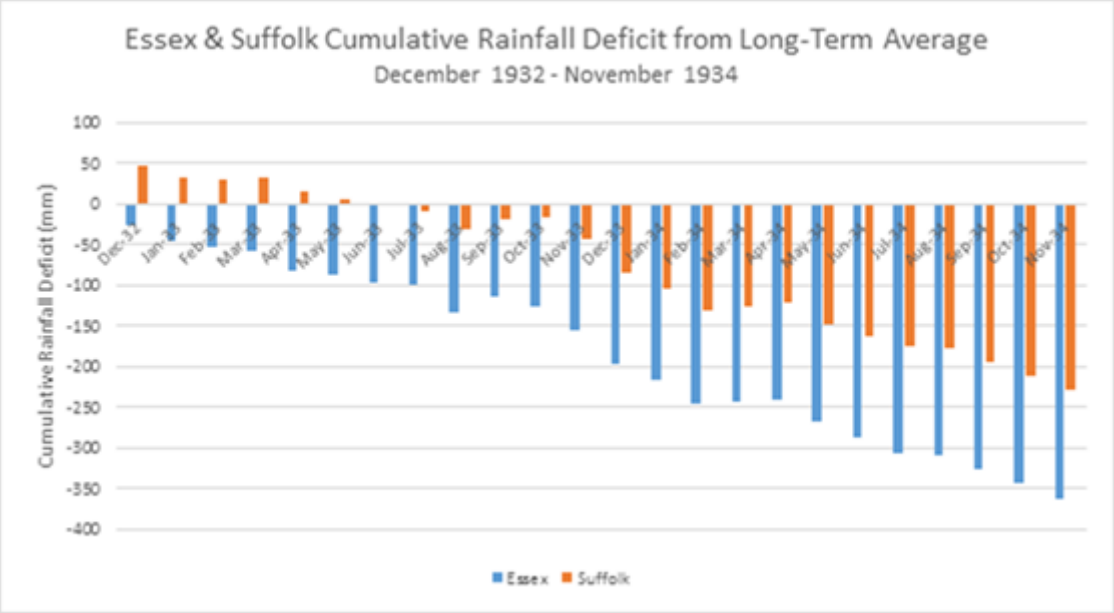


Figure 4: Monthly cumulative rainfall deficits for the early 1930s drought

Indicative return periods for durations of dry weather starting in December 1932 are summarised in the table below.

Table 4: Indicative return periods for durations of dry weather starting in December 1932

Duration	Return Period (years)
6 months	40
12 months	50
18 months	>200
24 months	>200
36 months	50

It can be concluded that the critical historical droughts affecting the Essex & Suffolk supply areas all have a return period greater than 1 in 200 years.

We were not required to apply for drought permits during the 1990s droughts, and modelling of a hypothetical 1 in 200-year return period drought on the current system for WRMP19 concluded that there is still a supply surplus during 1 in 200-year return period drought conditions. Therefore, the likelihood of needing to apply for a drought permit for any of the supply actions identified in this Drought Plan is very low.

Summary of Previous Droughts and Drought Measures

Background

The most recent periods of significant drought to have affected the Essex and Suffolk supply areas were during the 1990s. During these droughts in 1990-92 and 1995-97, we gained extensive experience of drought management. In the later drought, we implemented drought measures, including a hosepipe ban (now known as a Temporary Use Ban), in both supply areas.

A summary of how previous drought measures were implemented in recent droughts affecting Essex and Suffolk is presented below.

Essex

Hosepipe bans imposed in Essex during the 1990s occurred in the period from 29 July 1990 to 13 October 1992 inclusive, and 13 June 1997 to 3 April 1998 inclusive.

The 1990-92 drought was characterised by a prolonged period of below average rainfall that led to a lowering of groundwater levels throughout the southeast and parts of East Anglia, thereby impacting on baseflows to rivers. By contrast the 1995-97 drought was more directly impacted by the lack of rainfall, in terms of the absence of runoff to support the rivers on clay catchments.

The 1995-97 drought is worthy of further note in terms of the conditions that affected us and the actions we took to address supply concerns. Rainfall during 1995-97 in Essex was significantly lower than the long term average. Figure 5 displays monthly rainfall for 1995 to 1997, against the long term average for Hanningfield rain gauge.

A lack of winter rain, particularly in 1995 and 1996 resulted in incomplete reservoir refill. This is illustrated in the reservoir storage profile for Hanningfield Reservoir indicated also in Figure 5. It was this cumulative effect which made 1997 a particularly severe drought in East Anglia and necessitated the convening of our Drought Management Group (DMG), and the eventual imposition of drought restrictions.

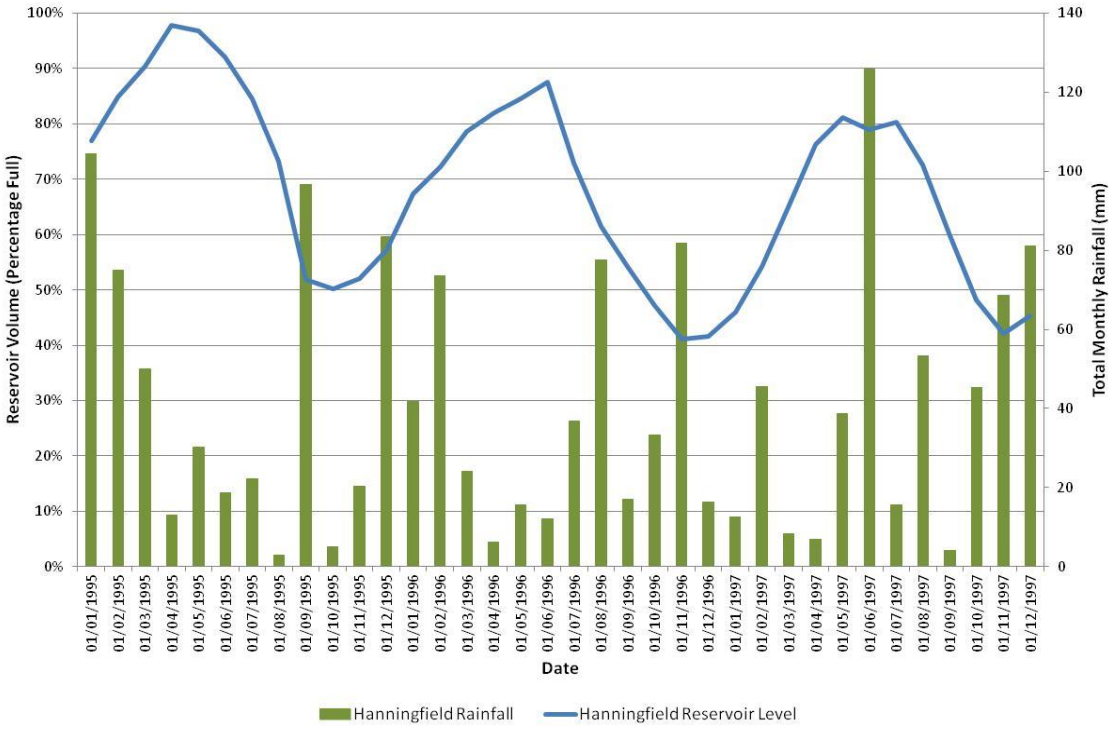


Figure 5: Hanningfield Rainfall and Reservoir Levels

Drought actions were first implemented in 1997 and were included in our Drought Contingency Plan released in March of that year. The DMG considered a wide variety of options, some of which were rejected for a variety of reasons, mainly related to timing

and feasibility. Drought actions that were implemented in Essex in 1997/98 included the following:

- Public relations campaigns (including press releases & radio advertising, fact sheets for opinion formers, posters & stickers, talks to local groups);
- Water efficiency initiatives (water conservation leaflets/newspapers etc);
- Hosepipe bans;
- Commissioning of abandoned sources (e.g. well in south Essex);
- Pumping capacity upgrades;
- Temporary effluent Recycling Scheme near Maldon; and
- Improving abstraction potential at Abberton reservoir via dredging.

A press conference took place on 11 June 1997 to announce the current water resource situation and the hosepipe ban. A press release was circulated beforehand to invite local press. A company-wide hosepipe ban was introduced with effect from midnight on 12 June 1997. It remained in force until we were reassured that there was no need for restrictions during the summer of 1998. The hosepipe ban ended in Essex on 3 April 1998, following a significant improvement in the water resources situation.

We successfully operated a temporary recycling scheme between July 1997 and December 1998. The scheme involved abstracting up to 23 Ml/d of wastewater from the Chelmsford Sewage Treatment Works pipeline and disinfecting with ultraviolet light, prior to mixing with water abstracted from the rivers Chelmer and Blackwater. The water was then pumped into Hanningfield Reservoir. The scheme was applied for through normal discharge consent procedures as opposed to a drought order. A permanent Effluent Recycling Scheme was commissioned in 2002/03.

Suffolk

The only hosepipe ban imposed in Suffolk during the 1990s occurred in the period from 13 June 1997 to 14 May 1998 inclusive.

Although the lowering of groundwater levels during the 1995-97 drought had the potential to impact on public water supplies sourced from groundwater in the Suffolk Hartismere and Blyth water resources zones, this was not the reason that restrictions were required. In reality, borehole yields held up extremely well with the exception of one Chalk source (Hartismere Borehole 6). It was the unprecedented high demand fuelled by a long hot summer, that meant that a hosepipe ban was necessary.

Drought actions that were implemented in Suffolk in 1997/98 included the following:

- Public relations campaigns and water efficiency initiatives (as for Essex);
- Hosepipe bans;
- Hartismere Borehole 4 environmental drought order;
- Development of a new groundwater source and treatment works (Hartismere Borehole 1);
- Hartismere Borehole 3 licence variation (increase in daily licence); and
- Road tankering.

A drought order to permit increased abstraction from Hartismere Borehole 4 to supply Redgrave and Lopham Fen with 8 l/s of water was implemented during the summer. This action safeguarded the breeding conditions required by the Great Raft Spider, and

freed resources enabling the company to use the full licensed quantity for public supply. Hartismere Borehole 4 was later closed and its replacement, Hartismere Borehole 5 was commissioned on 7th July 1999.

A successful tankering operation was implemented in Suffolk during 1997. Water was transported from a treated water reservoir near Lowestoft to discharge facilities in the Hartismere Water Resource Zone.

With an improving water resources situation in early 1998, hosepipe restrictions were finally lifted on 14 May 1998.

Effectiveness of Drought Plan

Approach

The 'dry year' is the fundamental basis of the supply and demand forecasts used in our Water Resources Management Plan. All of our demand forecasts are constrained in the sense that assumptions regarding demand-reducing measures such as metering, leakage control and water efficiency are included. We consider this to be a prudent decision since there is an overwhelming need to incorporate demand management at the heart of our water resource planning strategy. Demand management is seen as an ongoing essential option, regardless of whether a drought is occurring or not.

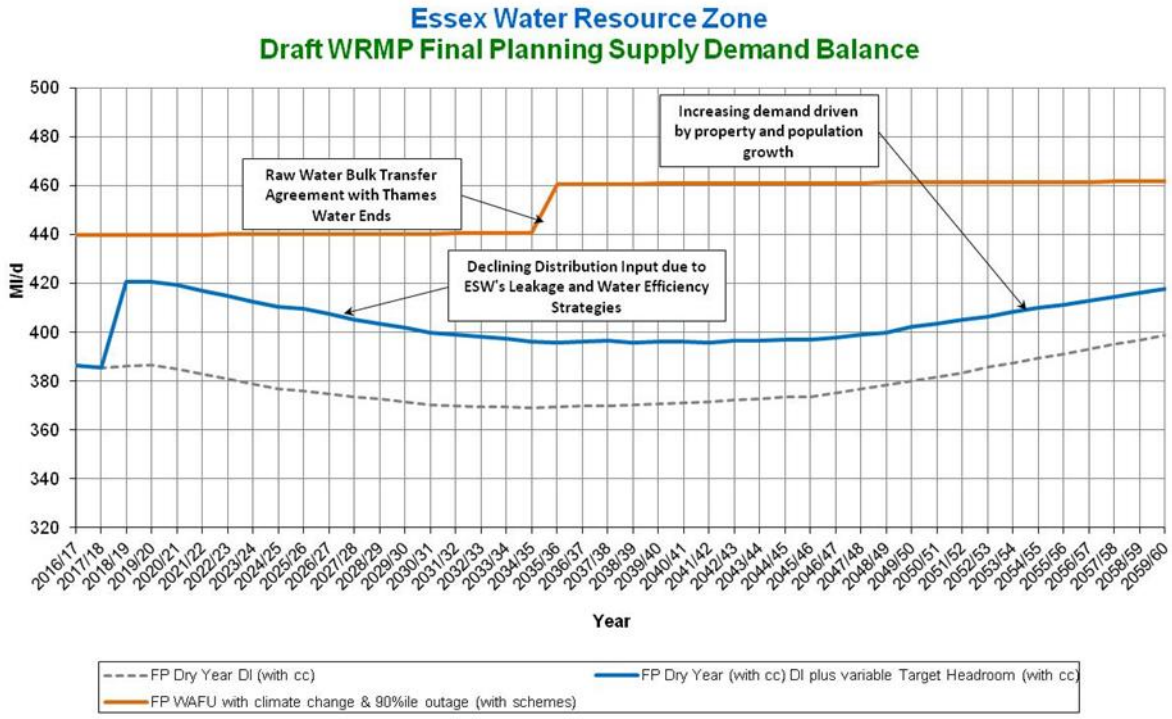
Operational experience has indicated that critical period scenarios such as those based on average day peak week (ADPW) are not appropriate for the Essex and Suffolk Water Resource Zones, as none of the zones are significantly peak constrained from a water resources perspective. In the case of the Essex zone, demand peaks can usually be absorbed due to the integrated nature of the supply network and the storage provided by the two large, pumped storage reservoirs. Similarly, in the Suffolk Northern / Central zone, the flexibility over utilisation of the three main surface water works near Lound, Barsham and Ormesby provide a buffer to impacts from peak demands. The groundwater-fed zones of Hartismere, and to a lesser extent Blyth, previously had peak/critical period concerns last observed in the 1995 to 1997 drought. These have now been addressed through investment in both zones in terms of intra-zone reinforcement and integration, and the development of new sources to support Hartismere. Hence no ADPW or similar peak scenarios are appropriate.

Essex Water Resource Zone

Worst Historic Drought on Record

The WRMP19 Essex DO can be used to demonstrate that drought triggers ensure that our Planned Levels of Service are met. The PR19 Essex System Aquator model was used to determine the rate of supply that can be maintained from the resource zone when the system is operated to meet our levels of service. The DO resulting from this scenario is defined at the point at which either water resources run out (i.e. resource constrained) or abstraction licensed quantities are used up (licence constrained). The DO for the Essex System is defined by the 1920-22 drought. The DO value is then used to determine Water Available For Use (WAFU)

WAFU (Ml/d) is greater than Distribution Input (Customer demand plus an allowance for network leakage) plus Target Headroom (an allowance for uncertainty) across the current statutory minimum 25 year planning period, and the 40 year planning period that we considered in our WRMP19. This is illustrated in the supply demand balance graph below. Consequently, for this scenario, it can be concluded that the Drought Plan ensures levels of service are met.



1 in 200-year and 1 in 500-year Return Period Droughts

The resilience of the Essex System to a 1 in 200-year return period drought was assessed for our WRMP19. The Scottish Method DO Analyser in Aquator was used for this assessment. For a drought with a 0.5% Annual Exceedance Probability (i.e. a 200-year return period drought), the result was a DO of 391 Ml/d, 1 Ml/d higher than our baseline DO, thus maintaining a significant supply surplus across the 25- and 40-year planning periods.

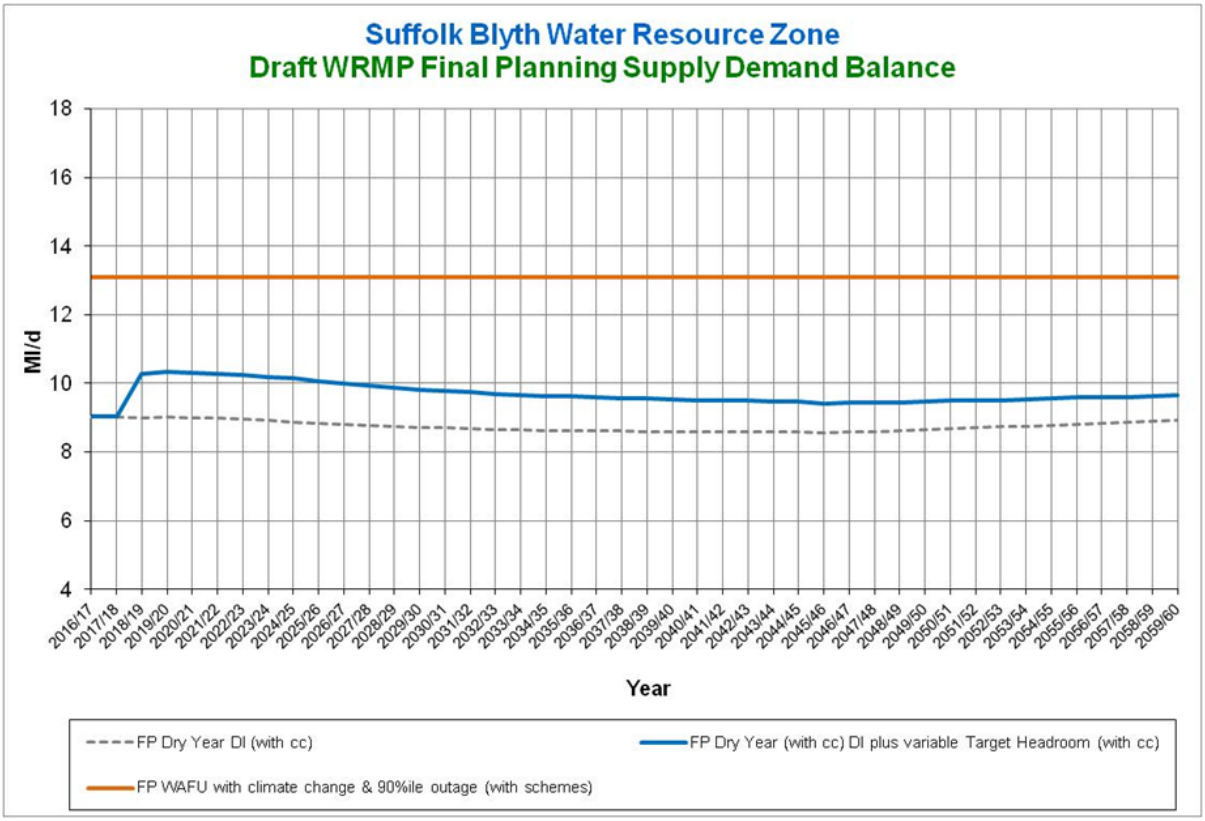
Our assessment of the resilience of the Essex System to a 1 in 500-year return period drought is outlined in Appendix 1.

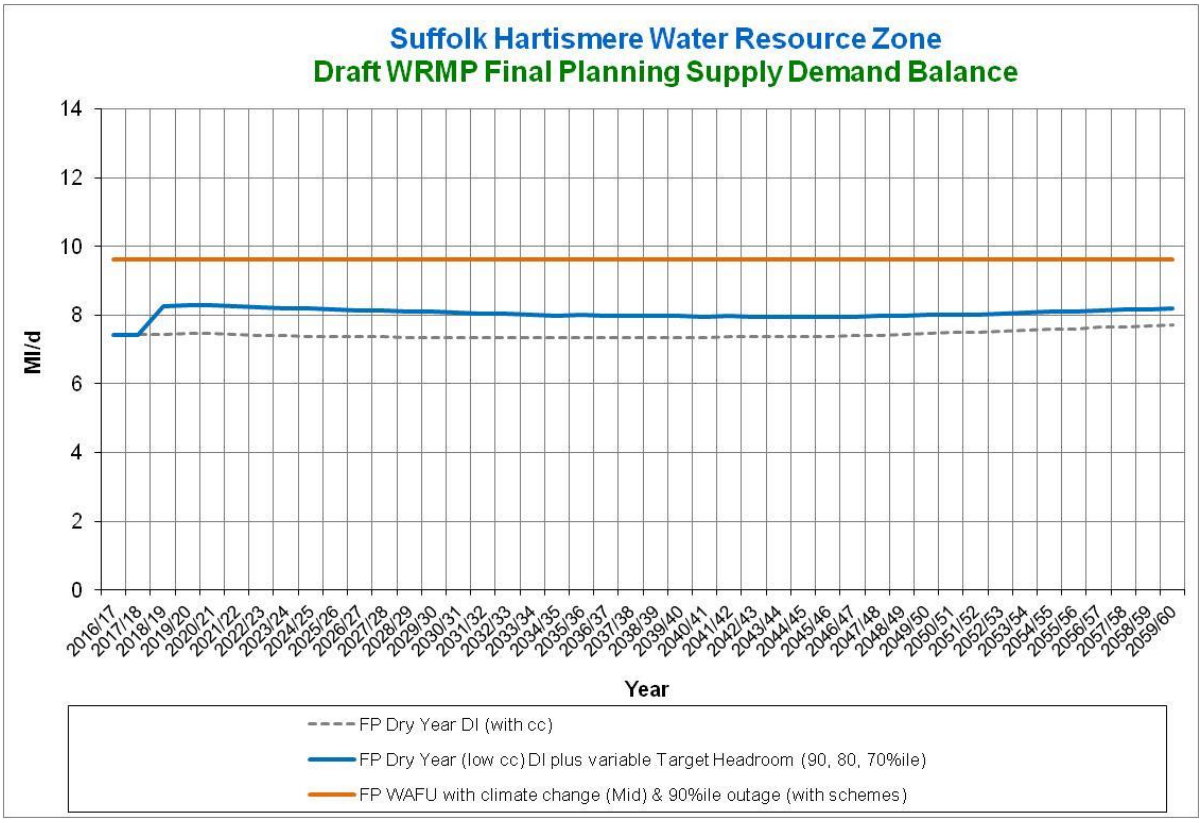
Suffolk Water Resource Zones

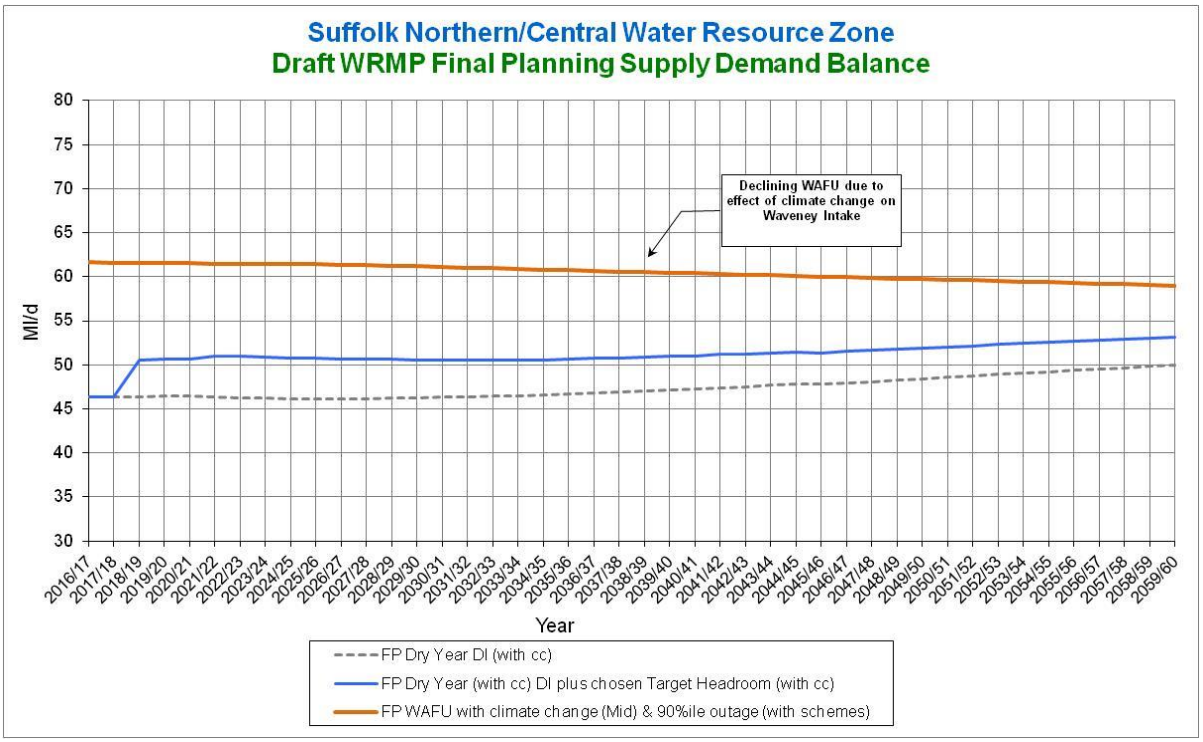
Worst Historic Drought on Record

The WRMP19 DO and WAFU assessments can also be used for the Suffolk Water Resource Zones (Blyth, Hartismere and Northern Central) to demonstrate that the Drought Plan ensures that our Planned Levels of Service are met. The design drought year for Suffolk is the 1995-97 drought, which was described earlier in this Appendix as having a return period of greater than 1 in 200 years.

Supply Demand Balance graphs for each of the Suffolk Water Resource Zones are illustrated below.







The supply demand balance graphs show that WAFU (Ml/d) is greater than Distribution Input (Customer demand plus an allowance for network leakage) plus Target Headroom (an allowance for uncertainty) across the 25 and 40 year planning periods that we considered in our WRMP19. Consequently, for this scenario, it can also be concluded that the Drought Plan ensures levels of service are met.

1 in 200-year and 1 in 500-year Return Period Droughts

We tested the resilience of our groundwater sources to a synthetic 1 in 200-year return period drought as part of our WRMP19. Amec Foster Wheeler (AFW) was employed to carry out groundwater modelling using the Northern East Anglian Chalk (NEAC) and Essex regional groundwater models.

Modelled groundwater heads for all our groundwater sources were determined. For each groundwater source the lowest modelled historical water level experienced between 1970 and 2014 was compared with the lowest modelled 1 in 200-year return period drought groundwater level during 1949 and 1950. The difference between these two groundwater level heads was then applied to the drought baseline curve for each groundwater source reliable output graph to determine whether there was likely to be a reduction in DO due to a 1 in 200-year return period drought.

From the groundwater modelling assessment, all Suffolk sources were found to be resilient to a 1 in 200-year return period drought, with no decline in DO. Consequently, the supply surplus illustrated in each of the Suffolk Water Resource Zone supply demand balance graphs illustrated above remain. This means that drought permits or drought orders could only be justified by an exceptional shortage of rainfall caused by a drought with a return period greater than 1 in 200 years.

Our assessment of the resilience of our groundwater sources to a 1 in 500-year return period drought is outlined in Appendix 2.

EXPERIENCE OF 2018, 2019 AND 2020

2018

Based upon analysis of cumulative rainfall and the number of days where temperature exceeded 25°C, 2018 was classified as a Dry year in both Essex and Suffolk. Average Distribution Input (DI) was 25Ml/d higher than the 2018/19 DI forecasted in WRMP14. Hanningfield reservoir storage was below average from June 2018, reflecting the dry summer and elevated customer demand. Abberton reservoir remained close to the post-enlargement average storage for most of the summer. Given our combined Essex reservoir storage, we did not need to introduce any formal customer restrictions on the use of water although we did escalate our dry weather messaging.

The average available headroom for 2018/19 based upon outturn data was 23.54Ml/d in Essex and 22.27Ml/d in Suffolk. We did not impose any customer restrictions on the use of water.

The Drought Vulnerability Framework assessment for the Essex System (Appendix 1) was modelling using actual DI from 2018/19, as it was our most recent classified Dry year to test our system with.

2019

Based upon analysis of cumulative rainfall and the number of days where temperature exceeded 25°C, 2019 verged on being a Dry year in Essex, and was classified as a Normal year in Suffolk. Average distribution input was 4Ml/d lower than 2018/19.

Combined reservoir storage started the summer slightly below average reflecting the conditions of the previous dry year. Due to a notably warm, dry summer in 2019, combined reservoir storage remained below average throughout the summer although we did not need to introduce any formal restrictions on use but we did enhance our dry weather messaging. River flows were low, with the River Stour measuring the second lowest river levels since the 1976 drought, and demands were higher than in 2018 at some points of the summer. Both reservoirs recovered to over 90% storage by the end of March 2020.

The average available headroom for 2019/20 based upon outturn data was 16.56Ml/d in Essex and 25.11Ml/d in Suffolk. We did not impose any customer restrictions on the use of water during 2019/20, and so our planned Levels of Service continued to be met.

2020

The rainfall in Essex was classed as Normal for the summer and for 2020 as a whole, with Exceptionally High rainfall in October. The summer had some contrasting periods with two heat waves, notably in May and August. Rainfall in Suffolk was also classed as Normal over the summer and for 2020 as a whole. Ormesby Broad level remained

within the target level band during the summer. Fritton Lake level was below average throughout the summer but remained well above minimum levels. Flows in the River Waveney were exceptionally low in June and July 2020, resulting in support from the Waveney Augmentation Groundwater Scheme in August, to ensure that we met the demand placed up our water treatment works. River Bure flows were below normal for most of the summer, but we were able to meet our abstraction requirements.

Hanningfield reservoir started summer 2020 full. It is the smaller of our two reservoirs and so we managed its storage so that it remained at or above average levels during the summer. It successfully refilled by the start of March 2021. Abberton reservoir storage is now 60% larger than Hanningfield reservoir and so we were able to draw more on its larger storage during the summer. Consequently, its storage reduced to 53% in November 2020 reflecting the exceptionally high customer demand. Abberton storage is now on track to achieve refill by the end of May 2021.

Given our combined Essex reservoir storage, we did not need to introduce any formal customer restrictions on the use of water although we did escalate our dry weather messaging.

The Covid-19 pandemic had a significant impact on customer demand during 2020 which also coincided with two heat waves in May and August. These coincident events resulted in unprecedented demands (25-30% above average on some days) in parts of our supply areas. The factors that influenced demand are described below:

- **Hand washing and home hygiene:** A key Covid-19 measure is enhanced hand washing and home hygiene which in itself, resulted in an increased demand for water.
- **Home working:** Home working had a significant effect on our Essex demand where large numbers of Essex residents normally work in London. This means their working hours water use has been transferred out of Thames Water's area back into our Essex supply area.
- **Garden Water Use:** With so many people at home and some being furloughed, people took the opportunity to spend more time in the garden and to both pressure wash their drives and patios, and to grow more flowers and vegetables.
- **Weather:** The summer was charachterised by two heatwaves in May and August. With so many people staying local and postponing holidays, we believe garden water use was much higher than would have normally been the case with increased use of kids "slip and slides", which require a continuous garden hose supply of water, and paddling pools. Some of the latter require a significant amount of water to fill which in most cases may be single use given how dirty the water quickly gets.

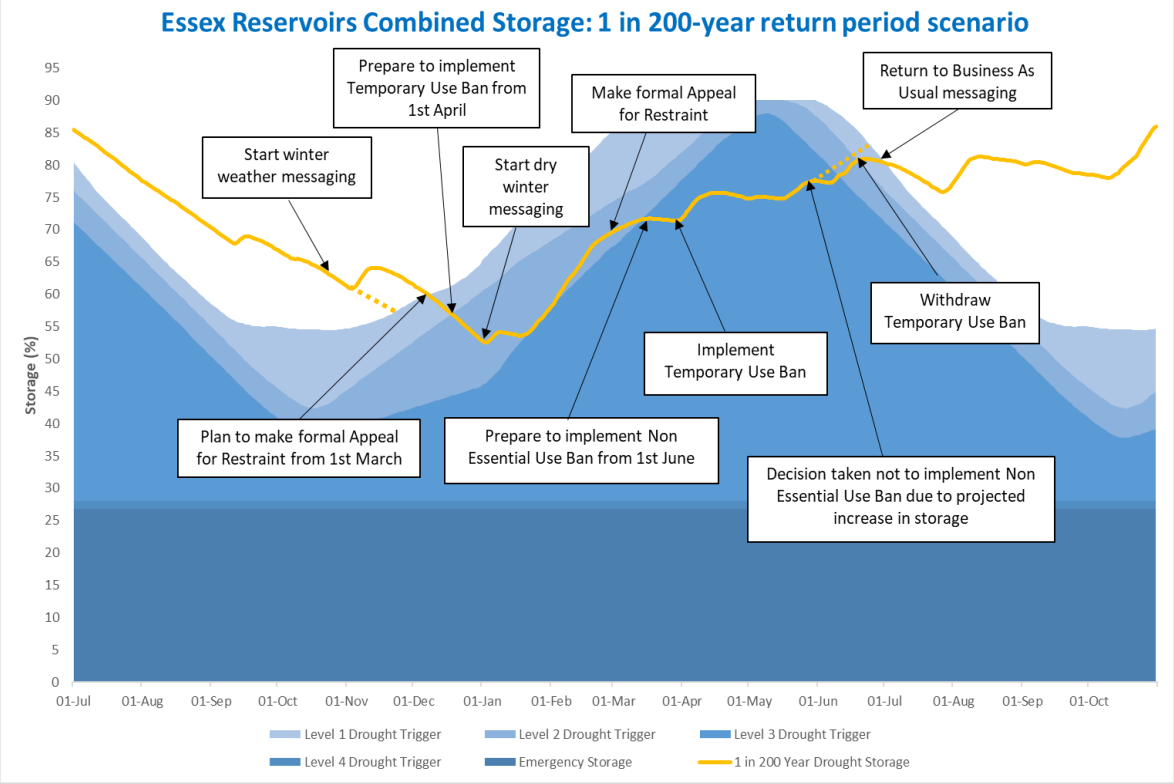
While demand was elevated in our supply areas, sometimes at record levels, we maintained supply to all of our customers.

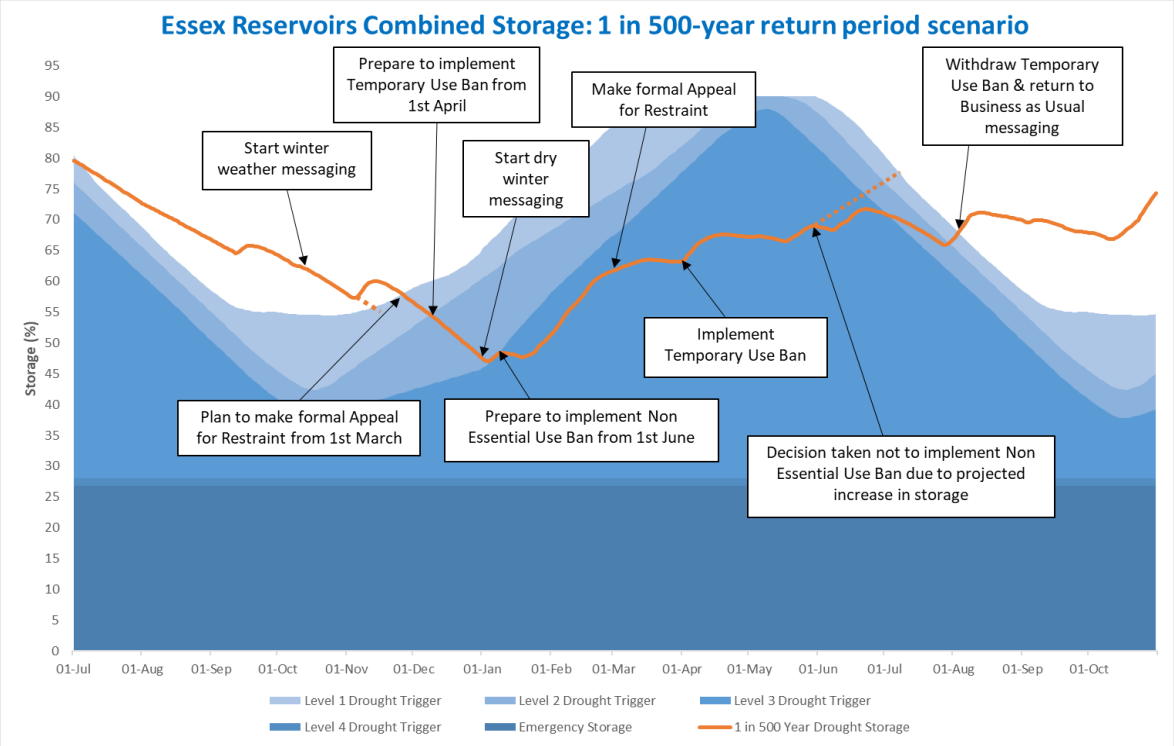
WORKED EXAMPLES

Essex WRZ

Drought triggers for our Essex WRZ are defined by the performance of the Essex System, based upon our combined Essex reservoir storage in relation to Level of Service control curves.

The following worked examples use reservoir storage modelled in our Essex System Aquator model for the Drought Vulnerability Framework analysis (see Appendix 1). The examples use a 1 in 200-year return period and a 1 in 500-year return period scenario, for a 24-month duration December-ending drought. The reservoir storage is based upon a demand on the system of 2018/19 DI plus Target Headroom allowance. The reservoir storage is plotted alongside our Level of Service curves, which are used in our WRMP deployable output modelling.





The graphs are annotated with the points at which we would implement our drought actions during the droughts. During the first autumn, with reservoir storage declining, we would forecast the continuation of decline to estimate when the storage is likely to reach the Level 1 trigger curve. We would decide to start winter weather messaging around a month before this point.

When the storage does cross the Level 1 curve, we would plan to make a formal Appeal for Restraint from 1st March, if the reservoir storage is still below the Level 1 curve at that point. When the storage crosses the Level 2 curve, we would prepare to implement a Temporary Use Ban (TUB) from 1st April, if the reservoir storage is still below the Level 2 curve at that point. The Environment Agency's Drought Permits and Drought Orders Guidance states that TUBs would not be expected to be implemented outside of 1st April to 1st October, when the demand saving is estimated to be minimal even if a measure is adopted. With our drought drawdown occurring in the winter months, we would therefore plan to implement drought restrictions in the spring, rather than implementing in the winter to little benefit.

In January, with the reservoir level still declining, we would decide to start communications about the dry winter we are experiencing. By 1st March, the storage is below the Level 2 curve in the 1 in 200-year scenario and below the Level 3 curve in the 1 in 500-year scenario, therefore we make a formal Appeal for Restraint. When the storage crosses the Level 3 curve, we prepare to implement a Non-Essential Use Ban from 1st June, if the storage is still below the Level 3 curve at that point. By 1st April the storage is below the Level 3 curve in both scenarios, therefore we implement a Temporary Use Ban. By 1st June the storage is still below the Level 3 curve, however we forecast that the storage will recover to 80% within 4-6 weeks. We therefore decide not to implement a Non-Essential Use Ban. As the storage recovers, we withdraw the Temporary Use Ban and revert to Business as Usual messaging.

The graph shows that Level 4 drought actions are not needed for either the 1 in 200 or 1 in 500-year return period scenario, based upon a demand of Dry Year DI plus Target Headroom.

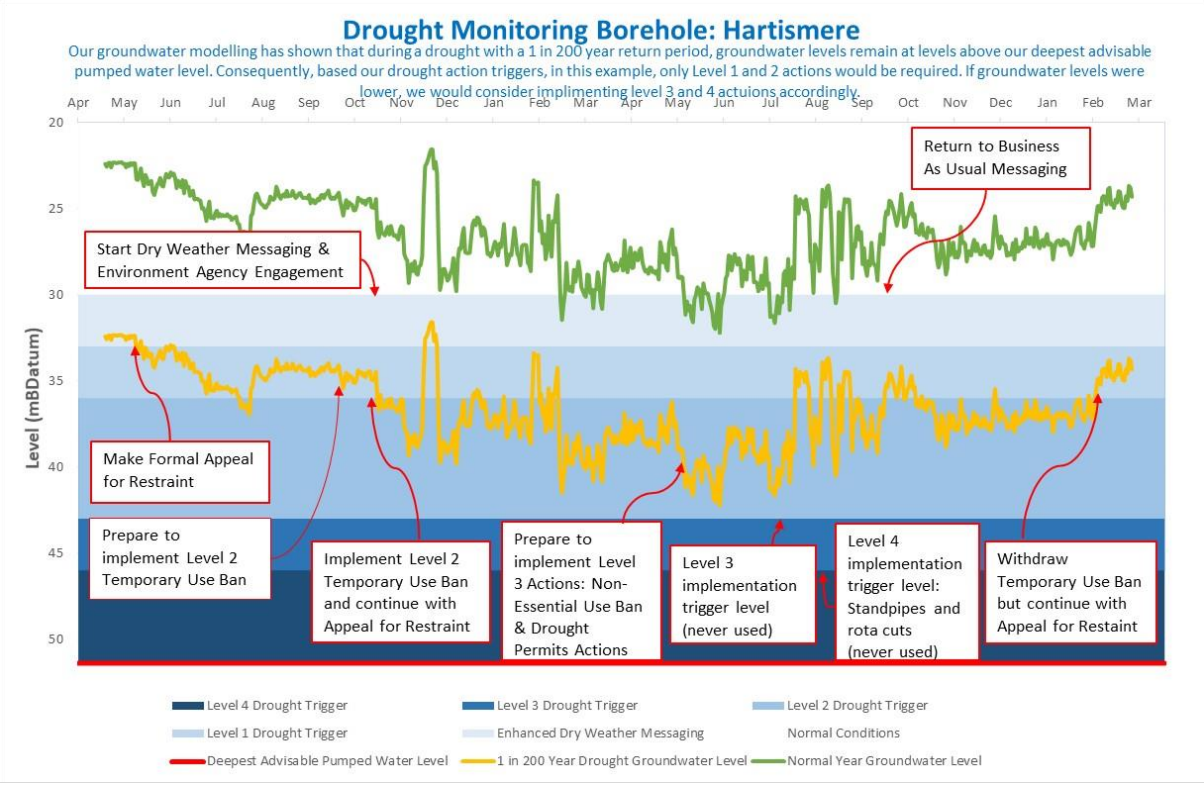
Groundwater Triggers

The drought triggers for the Suffolk groundwater sources have been defined based on our experience from the 1995/1996 drought. This drought was equivalent to at least a 1 in 200 year drought.

The following worked examples use recent actual data as the 'normal year groundwater level'. This dataset is then adjusted so that the lowest groundwater level recorded matches the lowest groundwater level recorded in drought years 1995/1996. This is to provide a representative daily dataset as the groundwater level was only recorded weekly in 1995/1996. Given the recent 1 in 500 year modelling that was undertaken for this draft Drought Plan does not result in any significant additional drawdown and none of the Suffolk groundwater source deployable outputs were impacted, we have now included a worked example for a 1 in 500 year drought.

Groundwater – Suffolk Hartismere 2 Chalk Borehole

Average daily 2018-2020 groundwater level data from the two operational boreholes was used as the 'normal year groundwater level'. The below graph shows the representative 1 in 200 year drought groundwater level, using the lowest 1995/1996 recorded level at Hartismere 2 as the minimum 1 in 200 year drought level.



The above trigger levels would be used in combination with the source reliable yield assessment graphs, groundwater levels in the Environment Agency's observation borehole and the DMG, to determine when to commence the drought action trigger levels.

Enhanced dry weather messages would commence when there has been limited recharge over the Autumn/Winter seasons and there is a declining trend in groundwater level to below average level.

Level 1 Appeal for Restraint and Level 2 Temporary Use Ban will be triggered according to limited recharge over Autumn/Winter and when the groundwater level is below average and declining. Engagement with the Environment Agency would commence when the groundwater level is below average and declining.

The mid-1990s drought was equivalent to at least a 1 in 200 year drought. During this drought the implementation of the Temporary Use Ban (previously named hosepipe ban) worked well and we were never in any danger of running out of water.

We have never implemented a Level 3 (non-essential use ban) or Level 4 (standpipe and rota cuts) drought actions. Therefore, we do not expect these to be required for a 1 in 200 year or 1 in 500 year drought. ESW boreholes have been resilient to previous droughts and only the Essex South Wells showed a reduction in deployable output from the regional groundwater drought modelling. The groundwater modelling determined that all Suffolk boreholes were resilient to the 1 in 200 year and 1 in 500 year drought scenarios.

Annual Licensed Quantity Utilisation Drought Trigger – Worked Example

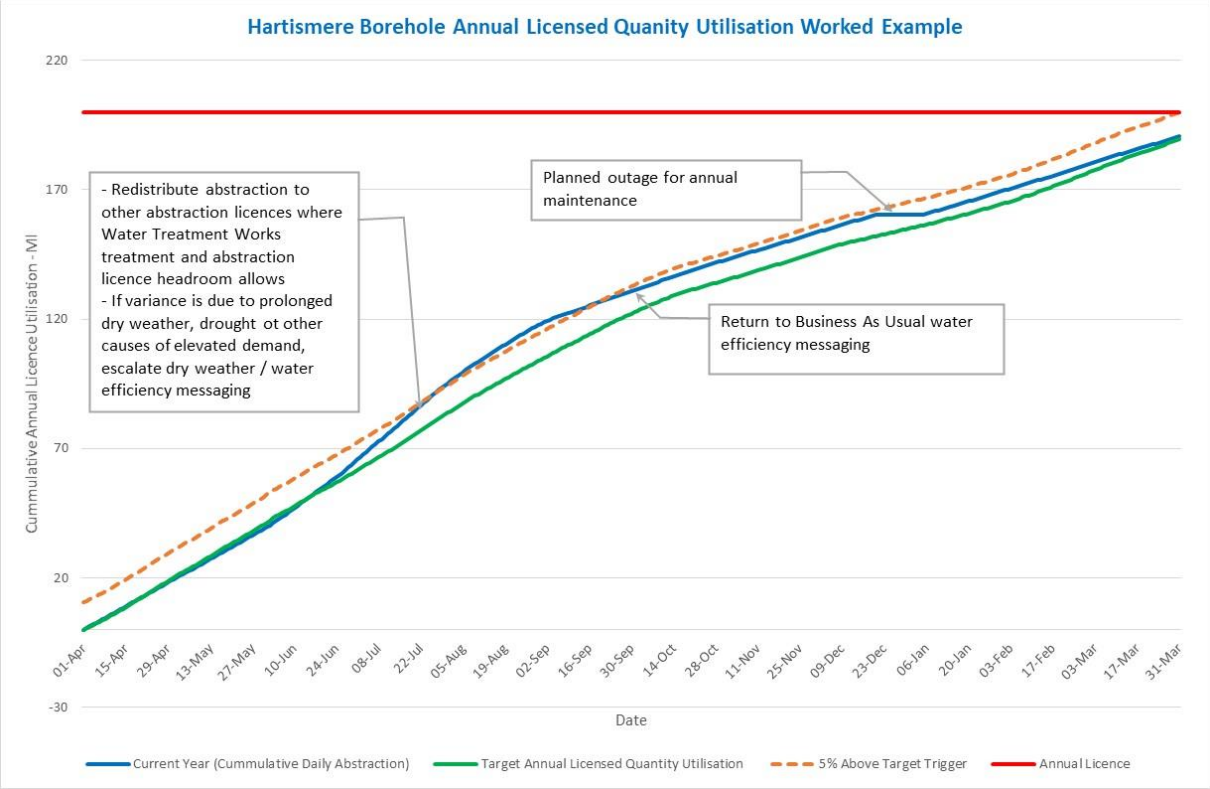
In our draft Drought Plan, we proposed to use a trigger for when utilisation of our groundwater sources is 15% over target. We have since reviewed this and consider a 5% variance to be more appropriate. This metric triggers operational changes and dry weather / water efficiency messaging to bring cumulative utilisation of the abstraction licence annual licensed quantity back to target levels.

Flexibility in abstraction is required within a Water Resource Zone. For example, a planned outage to allow planned maintenance at one Water Treatment Works will temporarily require increased abstraction at another. This can then be rebalance once the maintenance has been completed. However, the proposal to use a trigger for when utilisation of a borehole source is 5% over target is specifically in relation to prolonged dry weather and drought. We recognize the importance of reducing customer demand prior to considering supply side actions. Therefore, the actions associated with this trigger are to:

- redistribute abstraction to other abstraction licences where Water Treatment Works treatment and abstraction licence headroom allows; and
- if variance is due to prolonged elevated demand, escalate dry weather / water efficiency messaging.

We do not intend to use this metric on its own to trigger Level 1 (Appeal for restraint), Level 2 (Temporary Use Ban – TUB) and Level 3 Non-essential use bans drought actions.

The worked example below shows where actual cumulative abstraction (solid blue line) exceeds the target abstraction plus 5% (red dashed line) and where operational changes and dry weather / water efficiency messaging would be implemented.



APPENDIX 4:
DETAILED ENVIRONMENTAL ASSESSMENTS

Available on request:

waterresources@nwl.co.uk

APPENDIX 5:
SUMMARY DROUGHT OPTIONS FORMS

Demand Side Drought Actions

Demand Side Drought Action Name	Level 1 Appeal for Restraint
Trigger(s) Or preceding actions	Level 1 drought trigger as per worked examples (See Appendix 3) Would follow enhanced dry weather messaging
Demand Saving or DO of Option (Mld)(1)	~0 to 7% annual average ~0 to 14% peak
Location	By Water Resource Zone
Implementation Timetable Preparation time, time of year effective, duration	From DMG approving drought action: - 1 week to implement campaign Most effective during hot weather (late Spring and summer)
Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	None required – at water company discretion. Liaison with WRE, neighbouring water companies and EA
Risks associated with option	Customers already sufficiently water-wise resulting in lower saving.

Demand Side Drought Action Name	Level 2 Temporary Use Ban
Trigger(s) Or preceding actions	Level 2 drought trigger as per worked examples (See Appendix 3)
Demand Saving or DO of Option (Mld)	~0 to 5% annual average ~0 to 10% peak
Location	By Demand Management Area (Essex and / or Suffolk)
Implementation Timetable Preparation time, time of year effective, duration	From DMG approving drought action: - 2 weeks to place adverts in newspaper and plan media communication; followed by 3 weeks for representation after publishing on ESW's website
Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	None but liaison with WRE, neighbouring water companies, EA, CCW and Defra would take place.
Risks associated with option	Customers already sufficiently water-wise resulting in lower saving.

Demand Side Drought Action Name	Level 3 Non-Essential Use Ban Drought Order
Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3)
Demand Saving or DO of Option (Mld)	~0 to 2% annual average ~0 to 4% peak
Location	By Water Resource Zone
Implementation Timetable Preparation time, time of year effective, duration	From DMG approving drought action: 2 months to finalise drought order application and determination, communication with public, time to place adverts in newspaper and send prohibition notices. Maximum duration 3 months before extension required.
Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Emergency Drought Order Secretary of State Liaison with EA, CCW and Defra required.
Risks associated with option	Negative impact on affected businesses.

Supply Side Drought Actions

Supply Side Drought Action Name		Increased Bulk Transfers from Thames Water Utilities (By Agreement)
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Infrequent (not likely to occur within several decades)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3)
	Demand Saving or DO of Option (Mld)	**Peak:** Up to 27 Ml/d dependent on TWU position and availability.
	Location	Essex Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	From DMG approving drought action: 1 week.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Agreement with Thames Water required. Constraints include system constraints and WTW capacity at Chigwell WTW.
	Risks associated with option	Additional quantities not guaranteed to be available and may be highly variable
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	We have not completed our own environmental assessment for this action, as water will be provided within the bounds of the agreement with Thames Water Utilities.
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	N/A
	Summary of mitigation measures	N/A
	Permits / approvals needs for mitigation measures	N/A
	Impact on other activities, e.g. fisheries, industry	N/A

Supply Side Drought Action Name		Increase the Stour Augmentation Groundwater Scheme (Sags) Licensed Quantity By 10%
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Exceptional (extreme drought scenario) worse than 1933/34 (Essex design drought year)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) after Increased Bulk Transfers from Thames Water Utilities
	Demand Saving or DO of Option (Mld)	**Peak:** Highly variable range. 30 to 50 Ml/d plus losses
	Location	Essex Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	From DMG approving drought action: 1 to 2 months – time for drought order application and determination. Secretary of State Determination: A decision will normally be made within 28 calendar days from date of application.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Drought Order Secretary of State Liaison with Environment Agency & Natural England.
	Risks associated with option	Perceived and potentially actual negative impacts on environment.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	Minor to moderate – may include short term benefits as low flows in rivers augmented, supporting ecology.
	Level of confidence (H, M, L)	Medium – as drought action has not yet been required, there is no monitoring during or after its implementation.
	Summary of likely environmental impacts	Potential short term positive effect on river flows and associated ecology (fish, invertebrates etc) & water quality (e.g. DO & temperature). Longer term potential for reduced baseflow if increased SAGS use causes increased drawdown and slower recovery of GW levels.
	Summary of baseline information used	Majority of data held by EA as SAGS licence holder. Rainfall data, river flow data, abstraction data & GW level data for SAGS BHs, various ecological surveys.

Supply Side Drought Action Name		Increase the Stour Augmentation Groundwater Scheme (Sags) Licensed Quantity By 10%
	Summary of additional monitoring required	If a drought order is required to operate the SAGS boreholes outside of the 15-year licence conditions then ESW will work with the Environment Agency to analyse the appropriate data to support the application, based on the EA's groundwater level and river flow monitoring information.
	Summary of mitigation measures	If monitoring indicates significant GW drawdown use alternative SAGS BHs to mitigate potential longer term impacts on baseflow to river. For Stour, mitigate potential longer term impacts of reduced baseflow by use of EOETS environmental support in post-drought (recovery) phase. Withdraw drought action if significant effects observed.
	Permits / approvals needs for mitigation measures	ESW & EA would need to agree which SAGS boreholes to use, based on the EA's GW monitoring information and their preferred operational strategy for the particular drought.
	Impact on other activities, e.g. fisheries, industry	Potential impact on tourism, fishing.

Supply Side Drought Action Name		Reduction Of Compensation Flow From Hanningfield Reservoir Into Sandon Brook
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Exceptional (extreme drought scenario) worse than 1933/34 (Essex design drought year)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3)
	Demand Saving or DO of Option (Mld)[1]	**Peak:** Up to 0.9 Ml/d **Annual:** N/A
	Location	Essex Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	From DMG approving drought action: 2 months – time for drought permit/order application and determination, and communication with public. EA determination: Normally within 12 calendar days from date of application When there is a hearing, a decision will normally be made within seven calendar days of the receipt of the hearing report.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Drought Permit Environment Agency
	Risks associated with option	Potential negative publicity if the compensation discharge is NOT stopped (e.g. why release water from the reservoir when there is a drought on?).
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Minor – limited impact on undesignated site, as drought action is for a reduction, rather than a complete cessation of the compensation discharge.
	Level of confidence (H, M, L)	Medium – as drought action has not yet been required, there is no monitoring during or after its implementation.
	Summary of likely environmental impacts	Reduction in flow and water level in Sandon Brook could result in increased water temperatures, increasing BOD, reducing DO and potentially resulting in increased stress to fish, invertebrates and riparian desiccation. Reduction in flows could have positive or negative impact on INNS transfer & propagation.
	Summary of baseline information used	Rainfall data, water quality data (Hanningfield Reservoir & Sandon Brook), EA gauging station flow data, ESW spot flow gauging data on Sandon Brook, available ecological survey data.
	Summary of additional monitoring required	Increase frequency of in-drought and post-drought (recovery) monitoring of flow & water quality parameters (incl. DO) in Sandon Brook.

Supply Side Drought Action Name		Reduction Of Compensation Flow From Hanningfield Reservoir Into Sandon Brook
	Summary of mitigation measures	An iterative process with the compensation discharge being gradually reduced in steps and monitored. If environmental impacts observed, re-instate compensation discharge to full licensed flow. Consider aeration to maintain dissolved oxygen levels.
	Permits / approvals needs for mitigation measures	Permissions required from relevant landowners to access land to implement mitigation measures.
	Impact on other activities, e.g. fisheries, industry	None identified.

Supply Side Drought Action Name		Drought permit to reduce compensation flows from Hartismere Borehole 5
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Exceptional
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) and local supply and demand situation, and water resource situation.
	Demand Saving or DO of Option (Mld)[1]	**Peak:** Up to 690 cubic metres per day. **Annual:** N/A
	Location	Hartismere Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	At least four weeks, assuming 12 day decision time by Environment Agency and no hearing or objections.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Our abstraction licence makes an allowance for 690 cubic metres per day, 69,100 cubic metres per year, at an instantaneous rate not exceeding 50 litres per second, for the purpose of providing a compensation discharge, which is in addition to and separate from the amount allowed to be abstracted for public water supply. The separate conditions describing the three compensation discharge locations specify 'up to' an amount which totals 690 cubic metres per days across the three points. Requires a drought permit for change of purpose of abstraction if any of the amount allowed for compensation discharge is instead used to increase public water supply. No specific permissions over and above the drought permit would be required. ESW already has permission from the landowner to access the site.
	Risks associated with option	Minor – abstraction from groundwater remains within current annual and daily licensed maximum and reducing the compensation flow from the maximum allowed under the licence still maintains some freshwater input into surface waterbodies and near surface wetlands.
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Low - an AMP7 WINEP investigation is ongoing with respect to the sustainability of this source and the efficacy of the current compensation discharge arrangements and we have not experienced a drought since this source and drought action have been operational, so monitoring, although long term and ongoing, does not extend through a drought.

Supply Side Drought Action Name		Drought permit to reduce compensation flows from Hartismere Borehole 5
	Level of confidence (H, M, L)	Potential for temporary deterioration due to reduced flows of water into surface waterbodies and near surface wetland features, although still providing some compensation flow input would result in more water input than would be the case 'naturally' at that point in a drought, potential temporary deterioration in groundwater levels, although abstraction remains within daily and annual licensed maximum, potential for temporary impacts on fish and macro-invertebrates in pond receiving compensation discharge flow, potential for temporary drying & desiccation of flora and fauna in near surface wetland receiving compensation discharge flow.
	Summary of likely environmental impacts	ESW abstraction data, groundwater level monitoring at up to 10 points in area around the BH5 and compensation discharge points, across Chalk, Drift aquifers and near surface wetlands, level & flow data from EA gauging station on Waveney, rainfall data, groundwater quality monitoring in Chalk aquifer.
	Summary of baseline information used	Additional in-drought and post-drought (recovery) monitoring of temperature and DO in Hall Farm Pond. Increased frequency of baseline, in-drought and post-drought water level monitoring in shallow observation borehole on Hall Farm Meadow – requires the borehole to be re-drilled in order to accommodate a dip meter.
	Summary of additional monitoring required	Reduction of the compensation discharge flow in steps, with additional monitoring of pond water level, temperature & DO. Potential aeration of pond. Withdrawal of drought action if significant environmental effects identified.
	Summary of mitigation measures	May need additional permission from landowner to increase frequency of site visits for monitoring and to deliver mitigation measures.
	Permits / approvals needs for mitigation measures	None identified.
	Impact on other activities, e.g. fisheries, industry	Minor – abstraction from groundwater remains within current annual and daily licensed maximum and reducing the compensation flow from the maximum allowed under the licence still maintains some freshwater input into surface waterbodies and near surface wetlands.

Supply Side Drought Action Name		Drought permit to increase restricting annual quantity on Hartismere Borehole 4 Group licence from 2500 Ml/yr to 3000 Ml/yr
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Infrequent (not likely to occur within several decades)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) and local supply and demand situation, and water resource situation.
	Demand Saving or DO of Option (Mld)	**Annual:** 500 Ml/yr (from Hartismere Boreholes, 2, 3 and 7), i.e. 1.37 Ml/d equivalent. Wouldn't increase BH5. **Peak:** N/A
	Location	Hartismere Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	At least six weeks, if 28 day consultation with Natural England is required, assuming 12 day decision time by Environment Agency and no hearing or objections.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Requires a drought permit. Permission from landowners to access land to implement mitigation measures will be required.
	Risks associated with option	Risk that drought permit is not granted or that process is longer than envisaged. Risk that landowners do not allow permission to access land to implement mitigation measures.
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Minor – Review of Consents investigation with respect to local SSSI indicates no likely significant effect. Drought action is for a relatively small increase in overall groundwater abstraction, no increase in the daily max. licence at any source, and limited impact indicated by available monitoring.
	Level of confidence (H, M, L)	Low - Monitoring, although long term and ongoing, does not extend through a drought, and an AMP7 WINEP investigation is ongoing with respect to the sustainability of these sources.

Supply Side Drought Action Name		Drought permit to increase restricting annual quantity on Hartismere Borehole 4 Group licence from 2500 Ml/yr to 3000 Ml/yr
	Summary of likely environmental impacts	Potential temporary reduction in groundwater levels, potential temporary reduction in flows to near surface wetlands (incl. a SSSI), potential temporary reductions to base flows in local rivers, with potential temporary knock-on impacts in terms of water quality (DO), fish stress and desiccation of riparian habitat.
	Summary of baseline information used	ESW abstraction data, groundwater level monitoring at up to 30 points in area across Chalk, Drift aquifers and near surface wetlands, flow monitoring at 3 sites on upper River Dove, DO & temperature sampling on upper River Dove, level & flow data from EA gauging station on Waveney, rainfall data, groundwater quality monitoring in Chalk aquifer, Natural England ecological data for SSSI site.
	Summary of additional monitoring required	Potential increase in in-drought and post-drought frequency of some surface water flow and groundwater level monitoring.
	Summary of mitigation measures	Increased abstraction to come from BH 2, 3 & 7, not BH5, thus mitigating effects on all features (incl. SSSI). Withdrawal of drought action if significant environmental effects are identified.
	Permits / approvals needs for mitigation measures	Permissions required from relevant landowners to access land to implement mitigation measures.
	Impact on other activities, e.g. fisheries, industry	None identified.

Supply Side Drought Action Name		Increase Annual Quantity on Bedingfield Licence
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Infrequent (not likely to occur within several decades)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) and local supply and demand situation, and water resource situation.
	Demand Saving or DO of Option (Mld)	**Annual:** 50 Ml/year (equivalent to an additional 0.137 Ml/day) **Peak:** N/A
	Location	Hartismere Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	At least four weeks, assuming 12 day decision time by Environment Agency and no hearing or objections.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Requires a drought permit. Permission from landowners to access land to implement mitigation measures will be required.
	Risks associated with option	Risk that drought permit is not granted or that process is longer than envisaged. Risk that landowners do not allow permission to access land to implement mitigation measures.
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Minor – due to small increase in overall groundwater abstraction, no increase in the daily licence, and limited impact indicated by available monitoring.
	Level of confidence (H, M, L)	Low to medium – Monitoring, although long term and ongoing, does not extend through a drought, and an AMP7 WINEP investigation is ongoing with respect to the sustainability of this source.
	Summary of likely environmental impacts	Potential temporary reduction in groundwater levels, potential temporary reductions to base flows in local rivers, with potential temporary knock-on impacts in terms of water quality (DO), fish stress and desiccation of riparian habitat.
	Summary of baseline information used	Groundwater level monitoring at 12 points in area across Chalk, Crag & Drift aquifers, flow monitoring at 5 sites on upper River Deben, plus level data from EA gauging station, rainfall data, groundwater quality monitoring in Crag aquifer.
	Summary of additional monitoring required	Increased frequency of in-drought and post-drought (recovery) flow gauging of upper River Deben.
	Summary of mitigation measures	Potential to undertake river aeration to increase DO if observed to be an issue, otherwise withdraw drought action if significant environmental effects identified.
	Permits / approvals needs for mitigation measures	Permissions required from relevant landowners to access land to implement mitigation measures.
	Impact on other activities, e.g. fisheries, industry	None identified.

Supply Side Drought Action Name		Drought permit to increase restricting daily quantity on Blyth Borehole 6 licence from 0.91 Ml/d to 1.2Ml/d.
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Infrequent (not likely to occur within several decades)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) and local supply and demand situation, and water resource situation.
	Demand Saving or DO of Option (Mld)	**Peak:** Up to 0.29 Ml/d **Annual:** N/A
	Location	Blyth Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	At least six weeks, if 28 day consultation with Natural England is required, assuming 12 day decision time by Environment Agency and no hearing or objections.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Requires a drought permit. Permission from landowners to access land to implement mitigation measures will be required.
	Risks associated with option	Risk that drought permit is not granted or that process is longer than envisaged. Risk that landowners do not allow permission to access land to implement mitigation measures.
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Minor – available information indicates predominantly indirect impacts and monitoring data indicates limited impact, given there is no overall increase in annual total abstraction.
	Level of confidence (H, M, L)	Low – An AMP7 WINEP investigation, into the sustainability of the group licence which this abstraction is part of, is ongoing and monitoring, although long term and ongoing, does not extend through a drought.
	Summary of likely environmental impacts	Potential to temporarily reduce baseflows to local rivers, which may in turn reduce DO, increase the impact of barriers to fish movement and increase riparian desiccation. Potential temporary increase in drawdown and possible enlargement of borehole cone of depression. Potential that increased abstraction from the chalk could temporarily affect groundwater levels in the overlying sands and gravels and affect spring input into a SSSI.

Supply Side Drought Action Name		Drought permit to increase restricting daily quantity on Blyth Borehole 6 licence from 0.91 Ml/d to 1.2Ml/d.
	Summary of baseline information used	ESW abstraction data, groundwater levels in abstraction BH and local SSSI, river flow and DO data for Rivers Alde & Fromus, GW quality parameters for Chalk aquifer, rainfall data.
	Summary of additional monitoring required	Increase the frequency of flow monitoring on Rivers Alde & Fromus and DO monitoring on River Fromus during in-drought and post-drought (recovery) periods.
	Summary of mitigation measures	Possible aeration of rivers to increase DO if monitoring indicates significant environmental effect. Possible installation of a temporary weir to raise water levels in Gromford Meadows. Withdrawal of drought action if monitoring shows significant environmental effect.
	Permits / approvals needs for mitigation measures	Permissions required from relevant landowners to access land to implement mitigation measures.
	Impact on other activities, e.g. fisheries, industry	None identified.

Supply Side Drought Action Name		Drought permit to modify compensation flow and / or abstraction from Blyth Borehole 2.
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Infrequent (not likely to occur within several decades)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) and local supply and demand situation, and water resource situation.
	Demand Saving or DO of Option (Mld)	**Peak:** From up to 0.205 Ml/d from cessation of compensation discharge, up to 3.0 Ml/d if increase daily abstraction licence max. **Annual:** N/A
	Location	Blyth Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	At least six weeks, if 28 day consultation with Natural England is required, assuming 12 day decision time by Environment Agency and no hearing or objections.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	The current abstraction licence makes an allowance for the abstraction of up to 205 cubic metres per day during July to October inclusive for the purposes of making a compensation discharge, when requested by the EA, in addition to the amount allowed to be abstracted for public water supply. Reducing this amount and utilising some or all of the water made available by doing this for public water supply would require a drought permit for change of purpose. A drought action to increase the daily licence for public water supply purposes by an appropriate quantity (e.g. 2.8 Ml/d or 3.0 Ml/d) would also require a drought permit.
	Risks associated with option	Risk that drought permit is not granted or that process is longer than envisaged. Risk that landowners do not allow permission to access land to implement mitigation measures.
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Minor – available monitoring indicates limited impact, given there is no overall increase in annual total abstraction.
	Level of confidence (H, M, L)	Low – An AMP7 WINEP investigation, into the sustainability of this licence and others in the area, is ongoing and monitoring, although long term and ongoing, does not extend through a drought.

Supply Side Drought Action Name		Drought permit to modify compensation flow and / or abstraction from Blyth Borehole 2.
	Summary of likely environmental impacts	Possibility that abstraction from Crag aquifer could lower GW levels & reduce baseflow to rivers and reduce spring and seepage discharges into surface wetlands. Possibility that increased abstraction could cause saline intrusion into aquifer. Possibility that reduced base flow to rivers could lead to lower DO concentrations, fish stress and kills and desiccation of riparian habitat.
	Summary of baseline information used	ESW abstraction data, groundwater levels in abstraction boreholes, local observation boreholes and local SSSIs, river flow data for Hundred River & Leiston Beck, GW quality parameters for Crag aquifer, including chloride concentration, water quality parameters in surface and GW at SSSI sites, water quality parameters in Hundred River & Leiston Beck (incl. temperature & DO), surface water levels in wetland ditches, rainfall data.
	Summary of additional monitoring required	Increase the frequency of DO monitoring on Hundred River & Leiston Beck during in-drought and post-drought (recovery) periods.
	Summary of mitigation measures	Maintain compensation discharges to Hundred River and Leiston Beck. Potential aeration of Hundred River and Thorpeness Meare if environmental impacts observed. Withdraw drought action if monitoring indicates likely environmental impact on ground water, surface water or features of protected sites.
	Permits / approvals needs for mitigation measures	Permissions required from relevant landowners to access land to implement mitigation measures.
	Impact on other activities, e.g. fisheries, industry	None identified.

Supply Side Drought Action Name		Drought permit to increase annual licence and April to October quantities on Lound licence.
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Exceptional (extreme drought scenario)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) and local supply and demand situation, and water resource situation.
	Demand Saving or DO of Option (Mld)	**Annual Average:** Increasing April to October quantity might make an additional 222Ml of water available. Increasing the annual licence might make 295 Ml available. **Peak:** N/A
	Location	Northern Central Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	1 to 2 months – time for drought permit/order application and determination, and communication with public. EA determination: Normally within 12 calendar days from date of application When there is a hearing, a decision will normally be made within seven calendar days of the receipt of the hearing report.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Requires a drought permit, but no additional permissions, as ESW owns the lakes and has access to the lake shore.
	Risks associated with option	Risk that drought permit is not granted or that process is longer than envisaged. Risk that landowners do not allow permission to access land to implement mitigation measures.
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Minor to moderate – lake levels drew down to minimum levels during the last drought (1996/7) although the drought action was not required.
	Level of confidence (H, M, L)	Low to medium - drought action was not required during 1996/7 drought so no monitoring during implementation of current drought action. Most data sets, although long term and ongoing, do not extend through last drought (1996/7).

Supply Side Drought Action Name		Drought permit to increase annual licence and April to October quantities on Lound licence.
	Summary of likely environmental impacts	Potential for temporary deterioration in lake water levels from increased abstraction, although historically lake drawdown has rejuvenated springs within the system, maintaining a minimum water level through the 1990s droughts. Potential that if spring input to the lakes increases, this could drawdown groundwater levels and reduce the strength of the springs. Potential for reduced DO, increased algae growth and desiccation of marginal habitat.
	Summary of baseline information used	Abstraction data for ESW Lound Lakes abstraction points, surface water level data for Lound lakes & Fritton Lake, surface water quality parameters for Lound Lakes, GW level and various water quality parameters in two observation BHs. EA surface water quality data for Lound Run & Mill Water. Rainfall data. Various terrestrial & aquatic ecological surveys of lakes and meadows.
	Summary of additional monitoring required	Increase frequency of in-drought and post-drought (recovery) monitoring of DO in Lound Lakes.
	Summary of mitigation measures	Consider aeration of ponds / lakes if low DO and fish stress observed to be an issue. Withdrawal of drought action if significant effects observed.
	Permits / approvals needs for mitigation measures	No permits or approvals required, as ESW owns the Lound Lakes and has access to the lake shore.
	Impact on other activities, e.g. fisheries, industry	May have to temporarily close disabled fishing club on Hopton 2 Pond.

Supply Side Drought Action Name		Drought permit to increase restricting annual quantity on Ormesby / Bure licence.
Supply side action information	**Likelihood of Action Use** Regular / Infrequent / Exceptional	Infrequent (not likely to occur within several decades)
	Trigger(s) Or preceding actions	Level 3 drought trigger as per worked examples (See Appendix 3) and local supply and demand situation, and water resource situation. Additional water required over and above, or in a different geographical part of the network to, that available from the previous action. Maximise use of all other available resources and move water within the Resource Zone to meet demand.
	Demand Saving or DO of Option (Mld)	**Annual Average:** 1Ml/d (365Ml over a year) **Peak:** N/A
	Location	Northern Central Water Resource Zone
	Implementation Timetable Preparation time, time of year effective, duration	1 to 2 months – time for drought permit/order application and determination, and communication with public. EA determination: Normally within 12 calendar days from date of application When there is a hearing, a decision will normally be made within seven calendar days of the receipt of the hearing report.
	Permissions required and Constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Drought Permit
	Risks associated with option	Risk that drought permit is not granted or that process is longer than envisaged. Risk that landowners do not allow permission to access land to implement mitigation measures.
Summary of environmental assessment (incl. mitigation measures)	Overall environmental impact (minor, moderate, major or uncertain)	Minor – no impact on the Trinity Broads as any additional abstraction would be from the River Bure. The likelihood of this drought action, to marginally increase annual abstraction from the Belaugh intake, reducing nearby fen groundwater levels to an extent whereby conservation objectives are not met is deemed to be unlikely. Monitoring indicates winter tidal surges more likely cause of temporary increases in conductivity / salinity in the Bure than summer low flows.

Supply Side Drought Action Name		Drought permit to increase restricting annual quantity on Ormesby / Bure licence.
	Level of confidence (H, M, L)	Medium – monitoring does not extend through a notable drought such as 1996/7, however, the abstraction has been subject to a Review of Consents investigation which concluded that there is sufficiently low risk associated with FL abstraction that environmental outcomes are likely to be achieved with the minor increase in abstraction associated with drought action.
	Summary of likely environmental impacts	Potential for reduced river levels and flow. Potential to reduce adjacent fen GW levels & soil moisture, which could cause desiccation of flora and stress aquatic fauna. Potential for saline intrusion during periods of low flow, although monitoring indicates only an issue during winter tidal surges. Reduced river levels and flow could reduce DO and increase water temperature causing stress to fish and aquatic fauna.
	Summary of baseline information used	Rainfall data, surface water levels & near surface wetland groundwater levels at various locations, Crag GW levels, abstraction data for ESW abstraction points, surface water quality parameters at various locations (incl. TP, TON), ecological survey data, various datasets used for AMP4 Review of Consents Investigation.
	Summary of additional monitoring required	Additional in drought and post-drought (recovery) monitoring of water level and water quality parameters.
	Summary of mitigation measures	Additional water abstracted from Bure, to protect Trinity Broads. Adherence to Bure low flow conditions on abstraction licence. Withdrawal of drought action if significant effects observed.
	Permits / approvals needs for mitigation measures	None required.
	Impact on other activities, e.g. fisheries, industry	None identified.

APPENDIX 6:
EXCEPTIONAL SHORTAGE OF RAIN (ESOR) ASSESSMENT

The Environment Agency issued its latest draft guidance entitled *Hydrological guidance for the assessment of an Exceptional Shortage of Rain (ESoR)* on 18 March 2021.

The sections in the guidance that relate to drought permit and drought order applications are reproduced below.

Overview

An ESoR needs to be demonstrated as part of any future drought permit or drought order application. In the case of a drought permit or emergency drought order, the Environment Agency or Secretary of State, respectively, must be satisfied that a serious deficiency of supplies of water in any area exists or is threatened due to an exceptional shortage of rain. For a drought order, the Secretary of State must be satisfied that, due to an exceptional shortage of rain, a serious deficiency of supplies exists or is threatened, or such a deficiency in flow or level of any inland waterway to pose a serious threat to any flora or fauna which are dependent on those waters, exists or is threatened.

The EA's guidance states that it is not appropriate to set a prescriptive approach to assessing an ESoR case. Each drought and each situation is unique. This technical guidance provides additional detail on best practice for ESoR assessments and should be read in conjunction with the Environment Agency's supplementary guidance on drought permits and drought orders.

Practicalities

In the case of a water company drought permit application, the water company will undertake the ESoR assessment. A checklist for water companies has been included in this document (see Appendix A) and should be provided to water companies to help with their assessment. The ESoR assessment should include suitable graphical evidence, for example charts, maps and tables, as appropriate, to support the ESoR case.

The Environment Agency expects water companies to follow the methodologies outlined in its supplementary guidance on drought permits and drought orders.

As a minimum, the Environment Agency expect every assessment to include a rainfall ranking and SPI assessment for the full period of analysis available and if appropriate, supported by additional methods agreed by Environment Agency hydrologists.

Appendix A – Exceptional Shortage of Rain (ESoR) checklist for water companies.

Audience: Environment Agency

Purpose

This document is designed for water companies completing an Exceptional Shortage of Rainfall (ESoR) assessment as part of a drought permit application. You (the water company) must follow the checklist below when completing your ESoR assessment. You may wish to use the sub-headings below to structure your ESoR report. This document is not designed to be used as a template for your report.

Checklist

- Consult with the Environment Agency hydrology technical specialists, Area Drought Coordinator and water company lead (OCS) at as early stage as possible to agree the approach.

1. Introduction

- Provide an overview of the application and the area of interest.
- Provide details of the supply situation and the hydrological context.

2. Rainfall data

- You must use areal rainfall data for the catchment area of interest.
- In most circumstances, you should use the Environment Agency's HadUK / DRT dataset for Hydrological Areas which is provided to water companies on a monthly basis. If the Hydrological Areas are not appropriate then rainfall data can be extracted for a bespoke catchment area from the HadUK/DRT dataset by Environment Agency hydrologists. Fully explain which dataset has been used and why.
- If you have calculated areal rainfall yourself (you are strongly advised to avoid this):
  - You will need to demonstrate that your data is of better quality and / or more hydrologically relevant than the HadUK / DRT dataset.
  - Set out the limitations of the dataset.

- Your areal rainfall should be calculated in accordance with British Standard BS7843-4:201296. The rain gauges used must be quality controlled, have minimal missing data and be operated in accordance with British Standard.

3. Period of analysis

- Determine the start and end point of the period of analysis before starting the assessment. This is the period of the rainfall deficit which is used to support the ESoR case. You should agree the period of analysis with the relevant Environment Agency hydrologist, the Area Drought Coordinator and water company lead.
- The application should be submitted as soon as possible after the end of the period over which you believe the ESoR has occurred.
- Start of the period of analysis:
  - Provide clear evidence (e.g. charts / graphs) of the point at which the resource situation is no longer normal for the time of year. This should include both the onset of the rainfall deficit and the effects on the water supply situation.
  - Justify how the variables used here are reflective of the water supply situation in the catchment area of interest.
- End of the period of analysis:
  - Provide clear evidence (e.g. charts / graphs / reference to Drought Plan) that the rainfall deficit has triggered the need for a drought permit.
  - Use the latest rainfall data at the point of the application.

4. Geographical extent of analysis

- Provide justification for the catchment area used in the analysis. In most circumstances, this will be one or several of the Environment Agency's Hydrological Areas.
- Provide evidence of how the rainfall deficit is relevant to the catchment area of the public supply source or the wider integrated water resource zone / sub unit of this zone.
- Catchments less than 10 km² or those without a rain gauge located within them should not be used.

5. Technical rainfall analysis methods

- Refer to the Environment Agency's supplementary guidance on drought permits and drought orders. This is available internally on the Content

Cloud and externally it will be shared with water companies on SharePoint or by request from the Water-Company-Plan mailbox.

- Use the same rainfall dataset (usually HadUK / DRT) for each analysis method (as set out in the sections above) and the same historic period of record (from 1891).
- Use your assessment period of analysis for each method as your main evidence. If you use any shorter periods as supporting evidence (for example, the winter refill period), justify how these are relevant to the water resource situation.
- Detail any limitations and uncertainties associated with the methodology, and the possible impacts on the results.

6. Other meteorological and hydrometric measures

- This analysis should not detract from your evidence that the reason for a serious deficiency is an ESoR.
- Refer to the Environment Agency's supplementary guidance on drought permits and drought orders. This is available internally on the Content Cloud and externally it will be shared with water companies on SharePoint or by request from the Water-Company-Plan mailbox. The internal Environment Agency guidance document contains more details on best practice.
- Use your assessment period of analysis for each method as your main evidence. If you use any shorter periods as supporting evidence (for example, the winter refill period), justify how these are relevant to the water resource situation.
- Detail any limitations and uncertainties associated with the methodology, and the possible impacts on the results.

7. Overview / Other

- You should consider the relationship to the threat of a serious deficiency of supply in the catchment area of interest.
- You should consider the relationship to the water company system.
- You may wish to include a forward look based upon a meteorological forecast

8. Summary and conclusions

- Provide a summary of the evidence for an ESoR drawing on your evidence from your technical analysis.

APPENDIX 7: ENVIRONMENTAL PERMITS AND DROUGHT ORDERS

We will need to apply for a Drought Permit or Drought Order for the Level 3 supply side drought actions and Extreme Drought Measures in this Drought Plan. This Drought Plan has been developed using the Environment Agency's latest guidance entitled, *Drought permits and drought orders Supplementary guidance from the Environment Agency and Department of Environment, Food and Rural Affairs* (March 2021). The key points of the guidance is reproduced below.

Overview

Drought permits, ordinary drought orders and emergency drought orders are tools to manage water resources during a drought. These tools can help to maintain public water supply and can protect the environment.

The Water Resources Act 1991 (WRA 1991) as amended by the Environment Act 1995 and the Water Act 2003, allows for three legislative ways for dealing with drought situations: drought permits, ordinary drought orders and emergency drought orders.

Drought permits and drought orders are drought management actions that, if granted, can allow more flexibility to manage water resources and the effects of drought on public water supply and the environment.

Both the Environment Agency and water companies can apply for drought orders. When a water company is applying for a drought permit, the Environment Agency must be satisfied that the following conditions have been met before a permit is granted:

- 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 (See Appendix 6 above).

When a water company is applying for a drought order, the Secretary of State must be satisfied that the following conditions have been met for the drought order to be granted:

- a serious deficiency of supplies of water in any area, exists or is threatened

or

- such a deficiency in the flow or level of water in any inland waterway to pose a serious threat to any flora or fauna which are dependent on those waters, exists or is threatened

and that

- the reason for the deficiency is an exceptional shortage of rain.

If a water company is applying for an emergency drought order, the Secretary of State must be satisfied that the following conditions have been met for the emergency drought order to be granted. Both that:

- by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened

and that

- the deficiency is such as to be likely to impair the economic or social well-being of persons in the area.

The Secretary of State (for drought orders) or the Environment Agency (for drought permits) must be satisfied that these conditions have been met. If these conditions are not met, a permit or order will not be granted.

Even if a serious deficiency of supplies exists, a drought order or a drought permit cannot be granted if the serious deficiency of supplies has not been caused by an exceptional shortage of rain.

Main differences between drought permits and orders

The circumstances in which an applicant should apply for a drought permit, ordinary or emergency drought order are summarised in the table below.

	Drought Permit	Ordinary Drought Order	Emergency Drought Order
Legislation	**WRA 1991 Section 79A**	**WRA 1991 Section 74**	**WRA 1991 Section 75**
Who can apply?	Water company	Water company Environment Agency	Water company Environment Agency
Who authorises?	Environment Agency	Secretary of State	Secretary of State
Duration	Up to 6 months	Up to 6 months	Up to 3 months
Available Extensions	For a further 6 months	For a further 6 months	For a further 2 months
Minimum time for decision	Once application received, normally within 12 calendar days of the date of publication of the last advertisement. When there is a hearing, a decision will normally be made within 7 calendar days of the receipt of the hearing report.	A decision will normally be made within 28 calendar days from date of application. When there is a hearing, a decision will normally be made within 7 calendar days of the receipt of the hearing report. Please note that this period can be longer (or in exceptional cases shorter)	Same as ordinary drought orders
Legislation	WRA 1991 Section 79A	WRA 1991 Section 74	WRA 1991 Section 75

The available actions allowed by drought permits and drought orders are summarised in the table below.

Drought Permit	Ordinary Drought Order	Emergency Drought Order
For a water company ▪ To take water from any source specified ▪ To modify or suspend conditions on an abstraction or impoundment licence held by the water company	**For a water company** Same as for drought permits but also includes: ▪ To discharge water to specified places ▪ To modify or suspend discharges or filtering/treating of water held by water company ▪ To modify or suspend restrictions or obligations that apply to the taking, discharging, supply or filtering/treating of water held by others (including Environment Agency) ▪ To authorise the Environment Agency to stop or limit the taking or discharging of water from/to specified sources or places ▪ To prohibit or limit particular uses of water under Drought Direction 2011 (these provisions do not apply for emergency drought orders) **For Environment Agency** ▪ To take water from specified sources ▪ To discharge water to specified places ▪ To stop or limit the taking of water from specified sources □ To modify or suspend restrictions or obligations to taking, discharging, supply or filtering/ treating of water held by anyone.	**For a water company** Same as ordinary drought order but also includes: ▪ To prohibit or limit uses specified by water company ▪ To set up and supply water by means of stand pipes, rota cuts or water tanks in a water company area. **For Environment Agency** Same as for ordinary drought orders.

Water company drought plans and 'application ready' principles

Water companies are expected to identify all possible drought permits and drought orders and include details of each option in their drought plan as part of the range of drought management actions they plan to use. Drought Plans should include assessment of the environmental impacts of potential drought permits and drought orders and cover the arrangements for environmental monitoring and mitigation that may be required. It is also expected that during a drought, a water company will follow its drought plan.

Water companies should be application ready for more frequent drought permit and order sites that a water company plans on using. This means a water company should be:

- as ready as you can be to submit these permits and orders prior to your application
- have an environmental assessment for each permit and order listed in your drought plan.

Further work will be required at the time of application (for example a full statement of reasons case). However, permits and orders that are application ready are more likely to be processed and implemented swiftly, reducing delays and costs. Even with application ready permits and orders, early engagement with the Environment Agency and possible objectors will be required before submitting any drought permits or orders to avoid delays.

Environmental Reports

The applicant must submit an environmental report with any drought permit or order application which is based upon an environmental assessment, planned monitoring and mitigation.

We have prepared our environmental reports following the Environment Agency's latest supplementary guidance 'Environmental assessment for water company drought planning' (July 2020).

APPENDIX 8:
TEMPORARY USE BAN REGIONAL ALIGNMENT

The majority of Water Resources South East (WRSE) and Water Resource East (WRE) water companies, including Essex & Suffolk Water, have agreed the following universal TUB enforcement policy.

The following enforcement policy is a universal document for water companies to use when implementing a TUB.

TEMPORARY USE BAN ENFORCEMENT POLICY

1. Introduction

Essex & Suffolk Water is the statutory water and sewerage undertaker for an area covering approximately [add a broad descriptive geographical description e.g. 5000 square miles across London and the Thames Valley from Kent in the east to Gloucestershire in the west].

A map showing the region for which Essex & Suffolk Water is appointed to act as the statutory water undertaker is shown shaded in blue and attached to this document as Appendix A. This area is referred to within this document as “the Essex & Suffolk Water Region”.

On [date] Essex & Suffolk Water imposed, throughout the Essex & Suffolk Water Region, a prohibition on the use of water for a number of specified categories of use, in accordance with section 76 of the Water Industry Act 1991. This is referred to as the Temporary Use Ban or TUB. The TUB was imposed because of the serious deficiency of water available for distribution and its terms are as follows:

The TUB took effect from midnight on [date] following publication of the notice on the Essex & Suffolk Water website and in the London Evening Standard, The Times and the Daily Mail newspapers on [date]. The terms of the TUB are attached to this document as Appendix B.

Under the terms of section 76(5) of the Water Industry Act 1991, if any person fails to comply with the terms of the TUB that person shall be guilty of an offence and liable on conviction in the Magistrates’ Court to a fine of up to £1000.

This enforcement policy sets out the standards and guidance that will be applied by Essex & Suffolk Water when undertaking its enforcement role within the provisions of the Water Industry Act 1991.

Where infringements and contraventions are found, Essex & Suffolk Water will respond in a manner commensurate with the need to safeguard the availability of water available for distribution. Wherever possible, Essex & Suffolk Water will offer advice to those who may have contravened the prohibition in a bid to remedy

infringements in a timely and cost effective manner. However, in particular cases, offenders may face prosecution.

The purpose of this enforcement policy is to seek to ensure that when enforcement action is required, it is pursued in a consistent, balanced and fair manner.

2. Overall Aim

It is intended that this policy will seek to ensure compliance with the TUB within the Essex & Suffolk Water Region, in an attempt to conserve water, in a fair, open and consistent manner having regard, where appropriate, to the circumstances of each individual case and the extent to which the terms of the TUB have been contravened.

3. Guiding Principles

Whilst undertaking its regulatory and enforcement role in connection with the TUB, Essex & Suffolk Water will have regard to the following Guiding Principles:

- Any decision regarding enforcement action will be impartial and objective, and will not be affected by race, politics, gender, sexual orientation or the religious beliefs of any alleged offender, victim or witness.
- Essex & Suffolk Water will use as its starting position when considering enforcement of the TUB the belief that the vast majority of persons wish to comply with the terms of the TUB and should be assisted in doing so by Essex & Suffolk Water following the Investigational Phase process set out in Appendix C below ("the Investigational Phase"), if reasonably practicable.
- There will be a consistent approach to enforcement whilst recognising individual circumstances.
- Prosecution for an offence under the Water Industry Act 1991 will be considered in all cases, but particularly where a serious, severe, persistent and/or blatant breach of the relevant legislation has taken place or where alternative methods of resolution have failed.

4. Standards

Essex & Suffolk Water will try to meet the highest standards of service whilst undertaking its regulatory and enforcement function in connection with the TUB. The following specific level of service standards will be applied in connection with the TUB: -

- Matters relating to enforcement of the TUB will be dealt with promptly with written enquiries and complaints receiving a response or acknowledgement within ten working days.
- Employees of Essex & Suffolk Water employed to monitor compliance with the TUB will announce themselves on arrival at any premises and promptly show credentials/identification unless they are already known to the person or persons on such premises.
- Employees of Essex & Suffolk Water employed to monitor compliance with the TUB will provide their name and a Essex & Suffolk Water contact

telephone number to those persons with whom they are in written contact concerning enforcement of the TUB.

- Complaints relating to persons failing to comply with the TUB will be dealt with promptly, though we will always request the name and address of the complainant. Any such identification will be treated in confidence but may need to be disclosed (with prior consent) should formal legal proceedings be taken against the person or persons to which the complaint relates. Anonymous complaints, however, will still be investigated.
- Essex & Suffolk Water will be professional, courteous and helpful in its enforcement of the TUB and wherever possible will seek to work with persons towards compliance using the Investigational Phase.
- In accordance with the Investigational Phase at the onset of considering enforcement action Essex & Suffolk Water will provide the person(s) believed to be contravening the TUB in writing with full details of the manner in which it is alleged the TUB has been breached and the steps that are required to be undertaken and by when to avoid enforcement action being taken.

5. Consistent Enforcement

Consistent enforcement action is desirable, but absolute uniformity would be unfair by failing to recognise individual circumstances that may modify action to be taken where it is permissible. Consistency of approach whilst allowing a degree of discretion will be encouraged by:

- Appropriate training and supervision of those employed by Essex & Suffolk Water to monitor and enforce compliance with the TUB. Amongst other things, they will be made fully conversant with the terms of this Enforcement Policy and its Appendices.
- Ensuring there is compliance with the standards set out in this policy by Essex & Suffolk Water.
- Recognition that it may not be in the interests of justice to prosecute a person found to be breaching the terms of the TUB in those cases where there is only sufficient evidence to prove a minor infringement.
  The final decision whether or not to prosecute will be taken by Essex & Suffolk Water's Executive Management Team, who will be aware that each case is unique and must be treated on its own merits.

6. Assessing Appropriate Action (in cases of infringement)

The Investigational Phase that will be undertaken by Essex & Suffolk Water sets out the detailed steps that will be taken by Essex & Suffolk Water **before** enforcement action is taken against a person found to be contravening the TUB. Essex & Suffolk Water will seek to ensure that the process identified in the Investigational Phase attached below as Appendix C as it applies to each individual case will be followed to allow a person sufficient time to demonstrate compliance with the terms of the TUB before enforcement action will be taken.

Prosecution will normally be considered where one or more of the following criteria are satisfied: -

- There is a need to protect the public interest and the interests of the environment, health, safety and such other interests.
- Informal approaches have failed.
- The persons concerned have ignored requests for compliance with the TUB.
- There has been a repeated serious and/or blatant contravention which is a clear overt challenge to the TUB and has potential to undermine customer confidence in the fairness of the restriction.

Essex & Suffolk Water accepts that the decision to institute criminal proceedings against a person or persons who fail to comply with the terms of the TUB is a serious one that should only be taken after full consideration of all the facts.

Essex & Suffolk Water is not bound by, but chooses to accept the provisions of the Code for Crown Prosecutors, January 2013 As such, Essex & Suffolk Water will only institute criminal proceedings when it is satisfied that the two stages of the Full Code Test: (i) the evidential stage; and (ii) the public interest stage, have been met.

The evidential stage is passed when there is sufficient evidence to provide a realistic prospect of conviction against each defendant on each charge. A realistic prospect of conviction means that a bench of magistrates, properly directed in accordance with the law, is more likely than not to convict the defendant of the charge alleged.

The public interest stage is applied by balancing public interest factors for and against prosecution. A prosecution will usually take place unless there are public interest factors tending against prosecution which clearly outweigh those tending in favour. Public interest factors that can affect the decision to prosecute usually depend on the seriousness of the offence or the circumstances of the offender. Some factors may increase the need to prosecute but others may suggest that another course of action would be better.

Both the evidential and public interest stages will be considered fairly and objectively by Essex & Suffolk Water.

[Date]

Appendix A Map of Essex & Suffolk water Region

Insert a map showing the geographical area for which Essex & Suffolk water is appointed as the statutory water ("the Essex & Suffolk Water Region")

Appendix B: Terms of the Temporary Use Ban

Temporary Use Ban:
Section 76 Water Industry Act 1991
Potable* water supplied throughout the area of [Company name] Utilities Limited must NOT be used for the following purposes:

1. watering a 'garden' using a hosepipe;
2. cleaning a private motor-vehicle using a hosepipe;
3. watering plants on domestic or other non-commercial premises using a hosepipe;

4. cleaning a private leisure boat using a hosepipe;
5. filling or maintaining a domestic swimming or paddling pool (except when using handheld containers filled directly from a tap);
6. drawing water, using a hosepipe, for domestic recreational use;
7. filling or maintaining a domestic pond (excluding fishponds) using a hosepipe;
8. filling or maintaining an ornamental fountain;
9. cleaning walls, or windows, of domestic premises using a hosepipe;
10. cleaning paths or patios using a hosepipe;
11. cleaning other artificial outdoor surfaces using a hosepipe.

Definition of a garden
A “garden” includes all of the following: a park; gardens open to the public; a lawn; a grass verge; an area of grass used for sport or recreation; an allotment garden, as defined in section 22 of the Allotments Act 1922; any area of an allotment used for non-commercial purposes; and any other green space.

Exemptions
The following will be exempted from the restrictions:

i) using a hosepipe in a garden or for cleaning walls or windows of domestic premises, paths or patios, a private leisure boat or an artificial outdoor surface, where such use is necessary for health and safety reasons.

ii) people with severe mobility problems who hold a current Blue Badge as issued by their local authority will not be prohibited from using a hosepipe to water a garden attached to a domestic dwelling, plants on domestic premises, or allotments where the Blue Badge holder is the tenant.

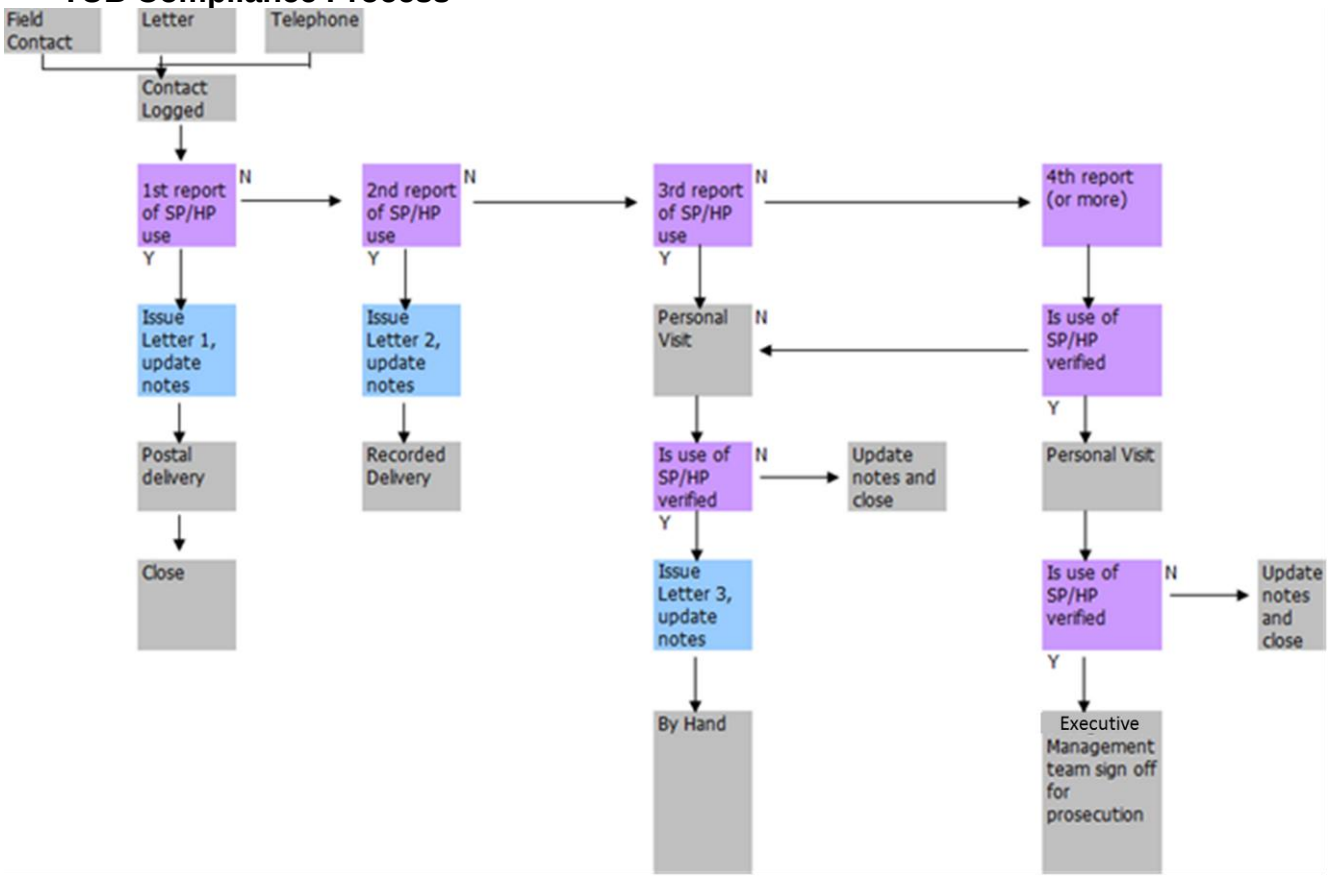
iii) using a hosepipe to clean a private motor vehicle, walls and windows of domestic premises, or paths, patios and other outdoor surfaces where this is done as a service to customers during a business.

iv) using a hosepipe to water an area of grass or artificial outdoor surfaces used for sport or recreation, where this is required in connection with a national or international sports event. A list of qualifying events will be published on [Company name]’s website and updated as and when required.

v) drip or trickle irrigation watering systems, fitted with a pressure reducing valve and a timer, that are not handheld, that place water drip by drip directly onto the soil surface or beneath the soil surface, without any surface run off or dispersion of water through the air using a jet or mist.

Appendix C: TUB Non-compliance Investigational Phase (Flowchart)

TUB Compliance Process



APPENDIX 9:
TEMPORARY USE BANS DEFINITIONS

Definition of "using a hosepipe"

For the purposes of a TUB, we have used the definition of "using a hosepipe" as that given in the Water Use (Temporary Bans) Order 2010 as follows:

a) Drawing relevant water through a hosepipe;
b) Drawing relevant water through a hosepipe from a container and applying it for the purpose; and
c) Filling or partly filling a container with relevant water by means of a hosepipe and applying it for the purpose.

A reference to a hosepipe includes anything designed, adapted or used for the same purpose as a hosepipe. "Relevant water" refers to mains water i.e. supplied by the water undertaker; it does not include water supplied before the water restriction was implemented.

The legislation does not state any exemptions to the definition of a hosepipe.

We considered whether micro-irrigation systems should be exempted from a temporary use ban but concluded that they should not be exempted. Whilst we recognise micro-irrigation systems use water more efficiently than a hosepipe or sprinkler, a 1 in 20 year ban is more about conserving water than using water more efficiently. If micro-irrigation was exempted from a hosepipe ban, more systems would be sold during the ban thereby decreasing some of the volume of water conserved from the imposition of the hosepipe ban.

The above definition of a hosepipe applies to all of the 11 categories detailed below:

1. Watering a garden using a hosepipe
2. Cleaning a private motor-vehicle using a hosepipe
3. Watering plants on domestic or other non-commercial premises using a hosepipe
4. Cleaning a private leisure boat using a hosepipe
5. Filling or maintaining a domestic swimming or paddling pool
6. Drawing water, using a hosepipe, for domestic recreational use
7. Filling or maintaining a domestic pond using a hosepipe
8. Filling or maintaining an ornamental fountain
9. Cleaning walls, or windows, of domestic premises using a hosepipe
10. Cleaning paths or patios using a hosepipe
11. Cleaning other artificial outdoor surfaces using a hosepipe

Although all of these uses of hosepipes are banned, it is important to note that during any TUB, gardens may still be watered:

- by hand using a bucket or watering can;
- with grey-water (ex bath/ washbasin water) through a hosepipe; and / or

- using rainwater from a water-butt through a hosepipe (assuming sufficient rainfall).

Further explanation of uses to be banned

Watering a garden using a hosepipe

The definition of "a garden" has been widened and clarified under the Water Use (Temporary Bans) Order 2010. We intend to ban the use of watering using a hosepipe for all categories allowed to be banned, with no exceptions.

The areas where watering a garden using a hosepipe will be banned under Phase 1 are:

a) a domestic garden
b) a park
c) gardens open to the public
d) a lawn
e) a grass verge
f) an area of grass used for sport or recreation
g) an allotment garden
h) any area of an allotment used for non-commercial purposes
i) any other green space

Exemptions: Under legislation a "garden" does not include the following, meaning hosepipe use is allowed to continue in these areas under a Phase 1 temporary use ban.

a) agricultural land
b) other land used in the course of a business for the purposes of growing, for sale or commercial use, any crops, fruit, vegetables or other plants.
c) land used for the purpose of a National Plant Collection.
d) a temporary garden or flower display
e) plants (including plant organs, seeds, crops and trees) which are in an outdoor pot or in the ground, under cover. NB for domestic purposes watering of these by a hosepipe is still banned under our Phase 1 but it comes under a different category in the legislation.

(Legislation excludes the banning of "watering a garden using a hosepipe" when the use is for "health or safety reasons". However, use of this exclusion is likely to be rare and the company would scrutinize the genuineness of such a claim).

Cleaning a private motor-vehicle using a hosepipe

Washing of any private motor vehicle, using a hosepipe is banned. This includes commercial car wash businesses that use hosepipes or pressure washers to wash customer's cars. Private cars can still be washed by householders and commercial businesses by hand using water from a bucket.

Exemptions: Legislation excludes:

a) a public service vehicle, as defined in section 1 of the Public Passenger Vehicles Act 1981; and
b) a goods vehicle as defined in section 192 of the Road Traffic Act 1988.

NB. Taxis and minicabs are public service vehicles and are therefore excluded from the ban.

Commercial carwashes, that do not use a hosepipe or similar apparatus, are also exempt from this ban.

Watering plants on domestic or other non-commercial premises using a hosepipe

This category covers the banning of watering by a hosepipe of plants which are in an outdoor pot or in the ground, under cover (predominantly plants growing in a greenhouse border).

“Domestic or other non-commercial premises” means

a) Any land, building or other structure used or enjoyed in connection with the use of any of the following which is used principally as a dwelling:

    - A building or part of a building
    - A caravan
    - A boat
    - Any land or premises which is not used principally for the purpose of a business

Exemptions: Legislation defines some exemptions: -

- Plants in outdoor pots and in the ground, undercover in public authority premises
- Plants in outdoor pots and in the ground, undercover in commercial premises
- Plants grown or kept for sale or commercial use
- Plants that are part of a National Collection or temporary garden or flower display.

Whilst Local Authorities are not restricted in their watering of plants, using a hosepipe, in outdoor pots or in the ground, under cover by the Phase 1 ban, we would expect them to also cease watering this category when a ban is imposed. This is likely to be seen to be fairer by the public and helps to fulfil a Local Authority’s duty under the Water Act 2003 to conserve water.

Cleaning a private leisure boat using a hosepipe

Using a hosepipe to clean a private leisure boat is banned. A private leisure boat is defined as “a vessel or other thing, other than a seaplane, which is designed, constructed or adapted to move through, in, on or over water”. Boats in private ownership only are included, whether trailer launched or not. The ban includes all small watercraft also e.g. canoes, kayaks, jet skis etc.

Exemptions: Legislation exempts the following:

- Vessels used in the course of a business
- Vessels made available or accessible to the public
- Cleaning of any area of a private leisure boat which, except for doors and windows, is enclosed by a roof and walls
- Using a hosepipe to clean a private leisure boat for health or safety reasons.

Filling or maintaining a domestic swimming or paddling pool

A domestic swimming or paddling pool is defined as swimming or paddling pool, other than a pool that is being used for the purpose of a business, which is:

a) in a building or part of a building used principally as a dwelling; or
b) on any land or in any building that is used or enjoyed in connection with (a).

Exemptions: Legislation excludes filling or maintaining a pool:

a) where necessary in the course of its construction
b) using a hand-held container filled with water drawn directly from a tap
c) that is designed, constructed or adapted for use in the course of a programme of medical treatment
d) used for the purpose of decontaminating animals from infections or disease
e) used in the course of a programme of veterinary treatment
f) in which fish or other aquatic animals are being reared or kept in captivity.

Drawing water, using a hosepipe, for domestic recreational use

This category covers the banning of the use of a hosepipe to operate water slides or other domestic recreational equipment. This is interpreted to mean both slides designed to be used with water and any temporary or ad hoc water slides or sprinklers. Recreational use covers the use by adults or children.

Exemptions: There are no legislative exemptions.

Filling or maintaining a domestic pond using a hosepipe

This restriction is fairly limited in the number of ponds likely to be affected. A wider ban on filling ponds comes in under the Phase 2 restrictions and requires the company obtaining a Drought Order under the Drought Direction 2011. A “domestic pond” is defined as a pond, including a swimming pond, on land that is used in connection with a building, or part of a building, used principally as a dwelling; and is not being used for the purpose of a business. A pond can be natural or man-made and can be internal or external and includes ornamental ponds.

Exemptions: Legislation excludes filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity.

Filling or maintaining an ornamental fountain

This category covers any water fountain or water cascade that serves a purpose that is primarily decorative. This includes sculptures that have a water component. Filling by any means is banned including permanent plumbing.

This ban applies equally to fountains, cascades and sculptures using water that are privately owned or publicly owned. It also applies to features that use recycled water.

Exemptions; Legislation exempts the filling or maintaining of an ornamental fountain which is on or near a fishpond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy.

Cleaning walls, or windows, of domestic premises using a hosepipe

This category refers to the cleaning of walls or windows on domestic premises using a hosepipe. The restriction also applies to businesses cleaning domestic walls or windows using such apparatus as water-fed poles.

A domestic premise is defined as:

a. A building used principally as a dwelling or dwellings
b. A garage, shed, outbuilding or other building or structure used or enjoyed in connection with a building used principally as a dwelling; or
c. A wall or other means of enclosure within the cartilage of a building used principally as a dwelling.

Exemptions: Legislation exempts cleaning activities for health and safety reasons. However, these are likely to be rare with health or safety reasons likely to be restricted to:

- Removing or minimising any risk to human or animal health or safety; and
- Preventing or controlling the spread of causative agents of disease.

Cleaning paths or patios using a hosepipe

This ban on use applies regardless of who is carrying out the cleaning and regardless of whether they are on domestic or commercial premises. The ban applies whatever the paths or patios are made of.

Exemptions: Legislation only exempts cleaning using a hosepipe for health or safety reasons. Again, these exemptions are likely to be rare and similar to the exemptions for H & S given in (**9**).

Cleaning other artificial outdoor surfaces using a hosepipe

This category bans the use of a hosepipe for outdoor cleaning of artificial surfaces regardless of who is doing the cleaning and regardless of whether the premises are domestic or commercial. Artificial outdoor surfaces are defined as:

a) Any area outdoors which is paved or laid with hard or artificial material;
b) Timber decking;
c) A quay (including a jetty, pontoon, wharf or slipway).
d) A trailer designed, constructed or adapted to launch boats or other vessels or craft into water, other than a private motor vehicle
e) The roof of any domestic premises.

Exemptions: Legislation only exempts cleaning using a hosepipe for health or safety reasons. Again, these exemptions are likely to be rare and similar to the exemptions for H & S given in (**9**).

APPENDIX 10:
NON-ESSENTIAL USE BAN DEFINITIONS

Commercial Premises

- For the purpose of a Drought Order, commercial premises are defined as:-
- "any land, building, other structure or premise not being domestic or other non-commercial premises within the meaning of the Temporary Water Use Ban".

Watering outdoor plants on commercial premises using a hosepipe

- This banning of activity covers:
  - Plants which are in a pot or other container that is outdoors or undercover
  - Plants which are in the ground under cover.
- Exemptions: Legislation exempts the watering of plants using a hosepipe that are: -
  - Grown or kept for sale or commercial use; or
  - Part of a National Collection or temporary garden or flower display.

Filling or maintaining a non-domestic swimming or paddling pool

- For the purpose of the Drought Order, the Drought Direction 2011 defines non-domestic swimming or paddling pools as "a swimming or paddling pool as defined and covered by the Water Industry Act S76(2)(e). The intention is that filling of domestic pools will already have been banned under the Temporary Water Use Ban.
- **Exemptions:** Legislation exempts the following from filling or maintaining pools:
  a. That is open to the public
  b. Where necessary in the course of its construction
  c. That is designed, constructed or adapted for use in the course of a programme of medical treatment
  d. That is used for the purpose of decontaminating animals from infections or disease
  e. Used in the course of a programme of veterinary treatment
  f. In which fish or other aquatic animals are being reared or kept in captivity
  g. That is for use by pupils of a school for school swimming lessons
- For the purpose of exemptions "Open to the public" is defined as:
- A pool is **not** open to the public if it may only be used if the user is a paying member of an affiliated club or organisation i.e. these are not exempt.

Filling or maintaining a pond

- This extends the areas of pond filling or maintaining being banned beyond those already covered by the Temporary Water Use Ban. Non-domestic ponds are now also covered by the ban on the use of hosepipes and both domestic and non-domestic ponds are banned from having water added by a fixed pipe. Ponds include manmade and natural ponds of any size.

- **Exemptions:** Legislation exempts the filling of any ponds, domestic or non-domestic, by hosepipe or fixed pipe, which contains fish or other aquatic animals that are being reared or kept in captivity. It also excludes the filling of any ponds using a hand-held container which is filled with water directly drawn from a tap.

Operating a mechanical vehicle-washer

- This is fully defined as "operating a mechanical vehicle-washer, whether automatic or not".
- **Exemptions:** There are no exemptions in legislation. While we are not considering any outright exemptions, we would intend to delay implementing this ban, for as long as we consider sensible, for mechanical washers that recycle water and use less than 23 litres of water per vehicle wash.

Cleaning any vehicle, boat, aircraft or railway rolling stock using a hosepipe

- A boat is interpreted, in this case, as a vessel or other thing that:
  - Is designed, constructed or adapted to move through, in, on or over water; and
  - Is not a private leisure boat within the meaning applied under the Temporary Water Use Ban.
- A vehicle is defined as any of the following which is not a private motor vehicle within the meaning of the Temporary Water Use Ban:
  - A vehicle, designed, constructed or adapted for use on roads; or
  - A trailer or other thing designed, constructed or adapted for attachment to a vehicle falling within a) above.
  - Railway rolling stock is interpreted to include passenger train cars, freight train cars, locomotives and tube trains.
  - Aircraft are interpreted to include privately and commercially owned airplanes, helicopters, gliders and hot air balloons.
- **Exemptions:** The only exemption in legislation is on the grounds of health or safety reasons.

Cleaning non-domestic premises using a hosepipe

- The activity to be banned is defined as:
  - Any exterior part of a non-domestic building other than a window
  - A non- domestic wall
- **Exemptions:** The only exemption in legislation is on the grounds of health or safety.

Cleaning a window of a non-domestic building using a hosepipe

- This restriction is equivalent in all ways to that covered under the Temporary Water Use Ban for domestic properties. The ban extends to the use of water fed poles where mains water is the source used to create the de-ionised water.

- **Exemptions:** The only exemption in legislation is on the grounds of health or safety.

Cleaning industrial plant using a hosepipe

- In this restriction "plant" is defined to mean "*The equipment, including machinery, tools, instruments and fixtures necessary for an industrial operation"*
- **Exemptions:** The only exemption in legislation is on the grounds of health or safety.

Suppressing dust using a hosepipe

- The Drought Direction 2011 defines "using a hosepipe" as:
  - Drawing relevant water through a hosepipe from a container and applying it for the purpose; and
  - Filling or partly filling a container with relevant water by means of a hosepipe and applying it for the purpose.
- This also includes anything designed, adapted or used for the same purpose as a hosepipe.
- **Exemptions:** The only exemption in legislation is on the grounds of health or safety.

Operating a cistern in any building that is unoccupied and closed

A cistern is defined as meaning an automatically operated flushing cistern which services a WC pan or urinal.

Occupation of a building by security staff is interpreted to comprise a building that is "unoccupied".

APPENDIX 11:
RELEVANT LEGISLATION AND GUIDANCE

In producing this draft Drought Plan, reference was made to the following guidance and legislation:

- Water Company Drought Plan Guideline 2020, Environment Agency
- The Drought Plan (England) Direction 2020
- Drought Plan Guideline Extra Information: Environmental Assessment for Water Company Drought Plans, May 2016, Environment Agency
- Drought Plan Guideline Extra Information: Supplementary Information, April 2016, Environment Agency
- Drought Plan Guideline Extra Information: Drought Permit and Order Application Ready, November 2016, Environment Agency
- Water Company Drought Plan Guideline 2011, Environment Agency
- Water Industry Act 1991
- Water Act 2003 where s.63 inserts new sections 39B & 39C into the Water Industry Act 1991 and s.62 inserts new sections 37B-D into Water Industry Act 1991
- Drought Plan Direction 2005
- Drought Plan Regulations 2005
- Drought Direction 1991
- Flood and Water Management Act 2010 where s.36 amends the Water Industry Act 1991 by substituting a new s.76
- Water Use (Temporary Bans) Order 2010
- Environmental Assessment of Plans and Programmes Regulations 2004
- Conservation of Habitats and Species Regulations 2010
- Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000, Section 28G.

APPENDIX 12: DROUGHT PERMIT AND DROUGHT ORDERS

This section provides further information on each of the drought permit and drought order extreme drought measures presented in Section 9.

Essex Water Resource Zone: Drought Order to Increase Abstraction from SAGS

Support the Environment Agency in making an application to the Secretary of State for a drought order to increase the 15-year abstraction licence volumes in respect of their SAGS boreholes.

There are sixteen Agency owned boreholes which can be operated under the Stour Augmentation Groundwater Scheme (SAGS), four of which are pond support boreholes, and twelve boreholes that augment flows in the River Stour to support ESW abstractions and transfers to Abberton reservoir.

The Agency's abstraction licence authorises during any period of fifteen years a maximum of:

- 25,000 Ml to be abstracted from boreholes 1 to 8;
- 9,450 Ml to be abstracted from boreholes 11 and 12; and
- 4,750 Ml to be abstracted from boreholes 15 and 16.

Daily licences for the SAGS boreholes are 10 Ml/d each for boreholes 1, 2 and 5, 12 Ml/d each for boreholes 11 and 12, and less than 4.5 Ml/d each for boreholes 6, 7 and 8. These daily licensed quantities reflect the results of borehole yield testing originally carried out at these sources. Thus, there is no scope for increase to the daily licensed volumes in the event of a drought.

The 15-year licence conditions are the only potential constraint on SAGS operation in a prolonged, severe drought that could be considered for a drought action. ESW, being the primary beneficiary of the scheme, will be expected by the Agency to provide the necessary information required to support a drought order application. In practice, the potential requirement for a drought order to increase the 15-year licensed volumes will be assessed and decided on by the EOETS Operators Group, i.e., both ESW and Agency personnel in collaboration.

Historical borehole utilisation until 31 December 2020 has been provided by the Agency and used to calculate the volumes remaining available on the 15-year licenses.

Boreholes	Utilisation (%) 2006 – 2020 (inclusive)	Volume remaining on 15-year licence (Ml)
1 to 8	14	21,385
11 and 12	28	6,831
15 and 16	35	3,082

If the daily licensed volumes are taken to be maximum capacities, and using the volumes remaining on the 15-year licences, the number of days of augmentation that in theory could be made by the three groups of boreholes is as follows:

- boreholes 1 to 8 could be run at maximum capacity for 337 days
- boreholes 11 and 12 could be run at maximum capacity for 285 days
- boreholes 15 and 16 could be run at maximum capacity for 257 days

This is a similar position to our previous Drought Plan.

The Environment Agency has a preferred switch-on order based on which boreholes have the highest and most reliable yield, and they also look to balance recharge to the aquifer over time. It is not possible to say beforehand which boreholes would be prioritised for use in any particular drought. This would be determined at the time of application in collaboration with the Environment Agency based on their groundwater monitoring information, and their preferred operational strategy.

The licence utilisation in 1997 totalled 7,442Ml, reflecting the 1996/97 drought, which was the last time ESW implemented a hosepipe ban. There is sufficient volume remaining on the three group 15-year licences combined, to pump the same volume on an annual basis for the next 4.2 years. Therefore, it is highly unlikely that the 15-year licence will become restrictive. Additionally, since we published our 2013 Drought Plan, the Abberton Scheme has now been completed meaning the need for this drought action is extremely unlikely.

These calculations indicate that there would be ample lead-in time, at least 12 months, to identify the potential need for the SAGS drought action and complete work to support any potential drought order application. If substantial support from the SAGS boreholes was required in a prolonged dry period, annual abstraction returns would be reviewed with the Agency to monitor 15-year licence utilisation and determine remaining volume availability. This would trigger the initiation of supporting monitoring or modelling.

This drought action would need the support of the Environment Agency which owns the abstraction licence.

Essex Water Resource Zone: Drought Permit to Reduce the Compensation flow from Hanningfield Reservoir into Sandon Brook

The drought action would be to apply for a Drought Permit to reduce the compensation discharge from Hanningfield Reservoir to Sandon Brook.

ESW is required under abstraction licence number 8/37/37/*S/0025 to make a compensation discharge of 0.909 Ml/d into Sandon Brook from Hanningfield Reservoir. A reduction of this discharge would potentially conserve additional, albeit very small quantities of water for public water supply use.

No specific permissions over and above the drought permit would be required. ESW already has permission from the landowner to access the site.

Blyth Water Resource Zone: Drought Permit to Increase Blyth Borehole 6 Daily licence

The potential drought action is to apply for a Drought Permit to increase the Blyth Borehole 6 daily licensed quantity from 0.91 Ml/d to 1.2 Ml/d.

At Blyth Borehole 6, the daily licence and treatment works capacity are 0.91 Ml/d and 1.2 Ml/d, respectively. Therefore, a small daily increase at this site may also be possible.

Permission from landowners to access land to implement mitigation measures will be required.

Blyth Water Resource Zone: Drought Permit to modify Compensation and/or Abstraction at Blyth Borehole 2

Potential drought actions may include Drought Permit applications to:

- Reduce the compensation discharge and maintain the daily licence; or
- Reduce the compensation discharge and increase the daily licence by an appropriate quantity. A suggested increase would be 3.0 Ml/d (10% increase).
- Retain the compensation discharge and increase the daily licence by an appropriate quantity. A suggested increase would be 2.8 Ml/d.

ESW, at the request of the Agency, is required to make a compensation discharge of 0.205 Ml/d (25 Ml/annum) between July and October inclusive from the Company's Blyth Borehole 2 to the Hundred River.

The high demand period for the Blyth zone is likely to be within the period that compensation discharges are required. Hence, one potential drought action is to reduce the compensation discharge and potentially look towards making the same daily quantities available for additional abstraction for public water supply purposes. Additionally, an increase to the daily licence may make additional quantities available for supply.

Permission from landowners to access land to implement mitigation measures will be required.

Northern Central Water Resource Zone: Drought Permit to Increase Annual Licence and April to Oct Quantities on Lound Abstraction Licence

The potential drought action is:

- to apply for a Drought Permit/Order to increase the licensed annual quantity of water that can be abstracted from Lound Ponds. A suggested increase would be from 2,955 Ml to 3,250 Ml (10% increase); and

- to apply for a Drought Permit/Order to increase the quantity of water that can be abstracted during the period April to October inclusive. A suggested increase would be from 2,216 Ml to 2,438 Ml (10% increase).

Surface water abstraction at Lound is constrained by a seasonal licence condition not to abstract more than 2,216 Ml during the period April to October inclusive. This is equivalent to 10.36 Ml/d which is significantly less than the daily licence of 20.4 Ml/d.

The annual licence is 2,955 Ml/annum, which has previously been a restriction during a drought year. Hence, the drought action to increase the annual quantities by 10% is seen as a prudent measure.
No permissions over and above the drought permit would be required as ESW owns the lakes and has access to the lake shore.

Northern Central Water Resource Zone: Drought Permit to Increase Restricting Annual Quantity on Ormesby/Bure licence

The potential drought action is:

- to apply for a Drought Permit/Order to increase the licensed annual quantity of water that can be abstracted from the Trinity Broad and the River Bure. A suggested increase would be from 10,000 Ml to 10,500 Ml (5% increase); and
- to apply for a Drought Permit/Order to increase the quantity of water that can be abstracted during the period April to October inclusive. A suggested increase would be from 7,500 Ml to 7,875 Ml (5% increase).

ESW is currently licensed to abstract 10,000 Ml per year from the River Bure and Trinity Broads combined with four Chalk boreholes. Additionally, the governing abstraction licence indicates that abstraction from the sources must not exceed 7,500 Ml in the period from April to October inclusive. The current annual licence quantity has been approached in previous drought periods. Hence, an appropriate increase via drought permit/order may release additional water for supply in dry years.

The Environment Agency has previously stated that it would only support a drought permit application to increase supplies from the Trinity Broads and the River Bure where ESW has a resource shortfall caused by an acute shortage of rain and that it would expect the company to have maximised its use of licensed resources prior to applying for a drought permit/order, and to move water within its resource zone to meet demand.

In terms of maximising use of existing resources, the recently commissioned Northern Central Transfer Scheme will allow north Gorleston (currently supplied only by Ormesby TWs) to utilise surplus resource in the south of the Water Resource Zone. The new pumping station and pipeline significantly increases resource zone resilience and reduces the likelihood of this drought action being required.

Nevertheless, the drought action remains valid. As agreed with the Environment, if this drought action were to be implemented, the additional water would need to be abstracted from the River Bure and not from the Trinity Broads. The additional

abstraction from the River Bure would be subject to the Hands Off Flow conditions outlined in the existing abstraction licence. The drought permit application would not look to change these. Additionally, it would not look to change the Trinity Broad abstraction cessation level.

Permission from landowners and the Broads Authority to access land to implement mitigation measures will be required.