Appendix 9

Drought permit application ready documents

Contents

1. Introduction

This appendix provides supporting information to meet government guidance regarding the preparation of drought permits, which states water companies "must carry out as much preparation work as possible in advance of a drought event. Applications for drought permits and orders should, in the majority of cases, be ready to submit prior to being needed."[1]

The document provides information to support applications for the following proposed drought permits, which are presented as separate sections:

- River Nene intake (Pitsford Water)
- River Nene intake (Rutland Water)
- River Great Ouse intake (Grafham Water)
- River Colne augmentation (Ardleigh Reservoir)
- Wellington Wellfield (Marham)
- River Wensum (Costessey groundwater sources)
- River Trent

There is also a section on the old proposed Alton Water drought permit explaining why this has now been removed.

Although presented here as a single document, the application ready packs are structured so that they can be read separately.

For each proposed drought permit, the recommendations set out by the Environment Agency[2] have been followed. Where information cannot be provided at this stage, we have described what our approach to obtaining and presenting the required detail would be.

All our drought permits have accompanying Environmental Assessment Reports (EARs) which assess the potential environmental impact of the drought permit and propose associated monitoring and mitigation requirements. These have been reviewed and updated for the Drought Plan 2022.

From our environmental assessments, we do not currently consider compensation is required as a result of the implementation of any drought permits except for the River Wensum (Costessey groundwater sources) permit where it may be required. This has been assessed during a review of mitigation requirements and details are included in the EARs, which are available on request. A summary of the EARs and environmental monitoring is also included in **Appendices 7 and 8** respectively. We will continue to review compensation requirements for all sites during EAR / mitigation updates that are routinely undertaken. Any changes will be included in the next Drought Plan update.

[1] *Environment Agency (2020) Water Company Drought Plan Guideline (Version 1.2)*
[2] *Environment Agency (2020) Environmental Assessment for Water Company Drought Plans - supplementary guidance*

2. River Nene intake (Pitsford Water)

2.1 Current licence and proposed drought permit

2.1.1 Current licence

Anglian Water is licenced to abstract from the River Nene for Pitsford Water.

The licence is subject to maintaining a Minimum Residual Flow (MRF) of 34.1 Ml/d in the River Nene immediately downstream of the abstraction point.

2.1.2 Proposed drought permit

The following permit application would be made for the River Nene:

- Reduction of the MRF by 50%, from 34.1 Ml/d to 17.05 Ml/d

In line with current guidance, the drought permit would initially cover a six month period of either October to March (inclusive) for a winter permit or April to September (inclusive) for a summer permit. Subsequent reapplication for a further six months may be considered if required, depending on the drought situation at the time.

This would require a new application and additional environmental assessments. However, we consider it is extremely unlikely that we would need to apply for a second six month period, based on analysis carried out for our WRMP 2019, which shows the majority of our supply system is resilient to severe drought (approximately a 1 in 200 year event).

The proposed drought permit would be triggered when storage in Pitsford Water is reduced and flows in the River Nene are low, although other factors such as water quality and rainfall will also play a factor.

Under the most likely scenario, a winter drought permit would be sought after a dry winter and summer, enabling us to refill the reservoir during the following winter. This typically corresponds to a natural increase in flows (and hence water available for abstraction) and a reduced sensitivity for the majority of potential environmental receptors. However, should drought conditions continue to present a significant risk to supply, a summer drought permit may also be considered as an option.

We have developed triggers to guide us through the different stages of the drought permit application process, and these are detailed in **Appendix 4**.

A copy of our current abstraction licence and a draft permit is available on request.

2.2 Justification of the need

2.2.1 Exceptional shortage of rain (ESOR)

For a Drought Order or permit to be granted, there is a legal requirement to demonstrate that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'.

Environment Agency guidance[3] states that it is not appropriate to set a prescriptive approach to assessing the ESOR as each drought and each situation is unique. The guidance provides a range of matters to consider when building the case for ESOR. This section provides an overview of our process for demonstrating an ESOR, following the guidance.

Rainfall is a key indicator in assessing drought conditions. Drought events vary in their duration, the time of year they commence and their magnitude (the extent of the rainfall deficit). Soil moisture conditions respond to precipitation anomalies on a relatively short timescale. Groundwater, streamflow and reservoir storage reflect the longer-term precipitation anomalies. These factors combine to produce a wide range of impacts on water resources.

As such, it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. The following data sources and methods would be used:

Standardised Precipitation Index (SPI)

We use the SPI to indicate the severity of low rainfall and if a drought may be developing. SPI values can be classified as shown in Table 2.1 following McKee et al. (1993)[4]. The World Meteorological Organisation's user guide[5] defines a drought event as occurring any time the SPI is continuously negative, and reaches an intensity of -1.0 or lower. The drought event ends when the SPI becomes positive.

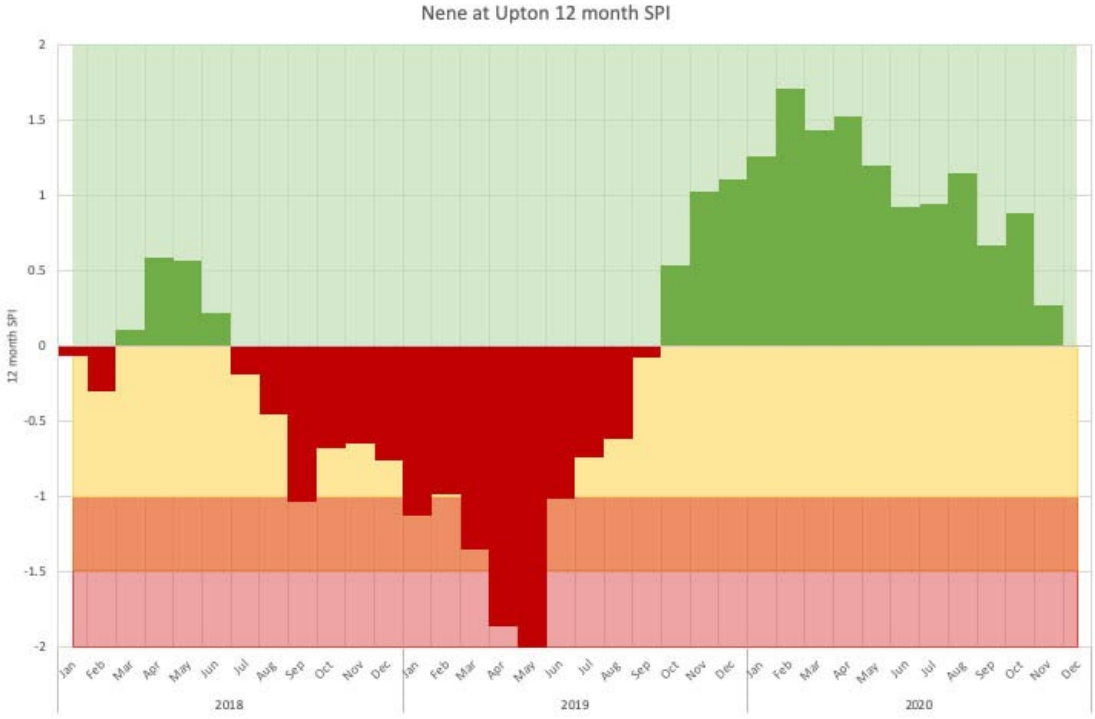
Table 2.1: SPI values

SPI	Rainfall scenario
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

For the River Nene at Pitsford, rainfall data for the Nene at Upton catchment is monitored at 1, 6, 12 and 24 month accumulations which allows the pattern and magnitude of longer term rainfall droughts to be measured. We use the 12 month accumulation SPI as an indicator in our drought response framework, and report on SPI as part of our BAU situation monitoring (Figure 2.1).

[3] *EA Drought Planning Guideline: Exceptional shortage of rain*
[4] *McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17-22 January 1993. Boston, American Meteorological Society, 179-184.*
[5] *World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.*

Figure 2.1: 12 month SPI chart for Nene at Upton



Atkins has carried out analysis of rainfall accumulation of historic and representative stochastically generated droughts at the sub-regional scale for the Anglian Water region[6]. We would compare the pattern and timings of contemporary rainfall accumulations with these historical and stochastic droughts in our assessment.

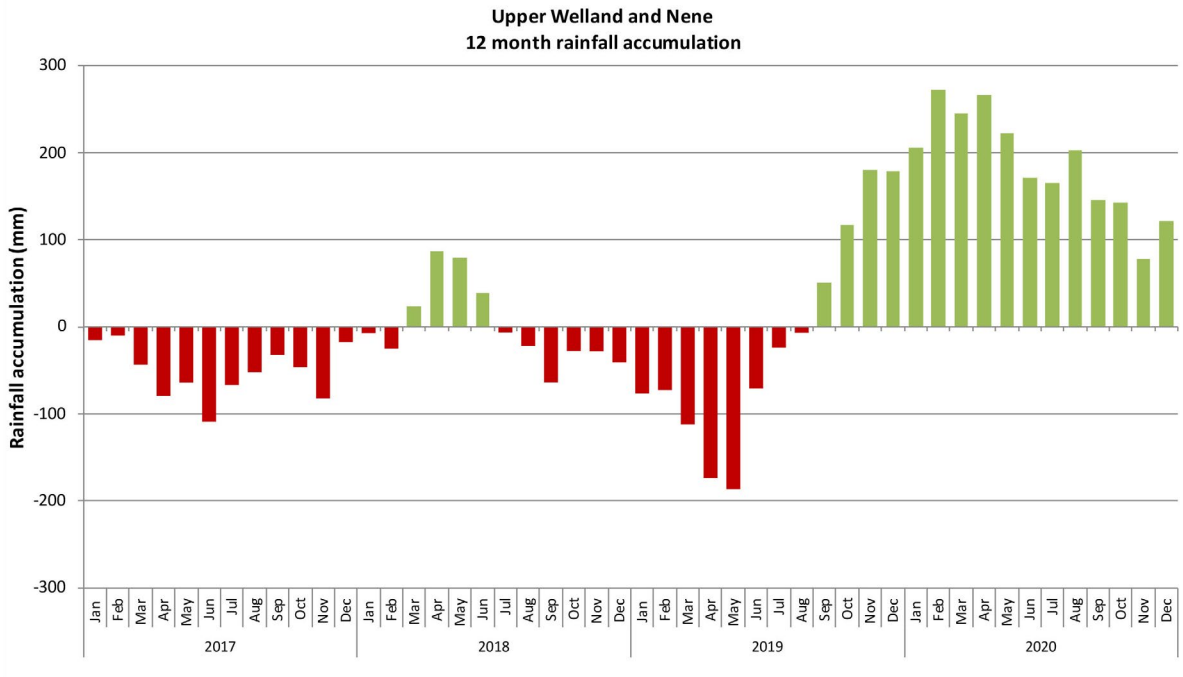
Rainfall ranking

We use the Environment Agency "rainfall by Hydrological Area" categorisations to monitor catchment variation in rainfall distribution. Rainfall data is collated by the Environment Agency from gauges within each hydrological catchment and aggregated for each area. The hydrological area is monitored at 1, 6, 12, 18, 24 and 36 month accumulations, which are then compared to the classifications derived from probability rankings and long term averages for each hydrological area. The probability bandings are derived based on Cunnane's calculations. These rolling rainfall accumulations allow the review of patterns and the magnitude of both annual and longer-term rainfall deficits (e.g. 1 or 2 dry winters) to be measured.

For the River Nene at Pitsford, rainfall data for the Upper Welland and Nene hydrological catchment is monitored at 1, 6, 12, 18, 24 and 36 month accumulations and classified as per the probability calculations discussed above. An example of the 12 month rainfall accumulations can be seen in Figure 2.2.

[6] *Drought Selection Process and Criteria - Anglian Water Services (Atkins, 2017)*

Figure 2.2: 12 month rolling rainfall accumulation (mm) departures from the Long Term Average for the Upper Welland and Nene



Other indicators of ESOR

We would support a case for ESOR by presenting other measures, such as soil moisture deficit, effective rainfall, temperature, river flows and groundwater levels (details on these data sources can be found in **Section 2.2, Main Plan**). This would include comparison to the long-term average and trend analysis. We would also describe our current operational water supply situation, to include reservoir storage levels against drought management curves, and forecast projections for a range of rainfall scenarios. Relevant impacts and mitigation actions carried out in the wider supply system would also be detailed.

2.3 Environmental assessment

An environmental assessment of the impact of the drought permit was carried out for the Drought Plan 2022 by Ricardo Energy and Environment, building on the work completed for the Drought Plan 2019 by Mott MacDonald / Atkins. This assesses the potential environmental impacts of implementing the proposed drought action, following Defra and Environment Agency guidance. The findings are detailed in a separate EAR, and summarised in **Appendix 7 and 8**, with a brief overview here.

The impact on river water level is assessed to range from major-negligible depending on distance from the drought permit abstraction point, although there is a greater potential for impact under a summer permit should lock operation peak significantly. There is a risk of increased orthophosphate concentrations, as well as increased potential for algal blooms. This may impact upon fish communities, macroinvertebrates, macrophytes, navigation, and aesthetics. However, the impacts are considered temporary, with intermittent periods of higher flows expected, as well as higher flows in the recovery period, flushing nutrients and other pollutants out.

The Habitat Regulations Assessment (HRA) Stage I: Screening Assessment concluded that there are no likely significant effects of the proposed drought permit upon European designated sites.

The key findings of the environmental assessment are summarised in Table 2.2.

Table 2.3 shows baseline, pre-drought, during drought, mitigation measures and post drought surveys for the proposed drought action on the Nene for Pitsford.

Table 2.2: Summary of environmental impacts of proposed drought permit in the River Nene (Pitsford Water)

River Reach	Reach 1		Reach 2		Reach 3		Reach 4		Reach 5		Reach 6		Commentary
Impact	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	
Hydrology (Level and flow)	Major	Moderate	Moderate	Moderate	Minor	Minor	Negligible	Negligible	Negligible	Minor	Negligible	Minor	Reduced level and flow, leading to reduced wetted width.
Geomorphology	Negligible	Minor	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Reduced sediment transport capacity in channel.
Water Quality	Major**	Moderate*	Moderate*	Moderate*	Minor*	Minor*	Negligible	Negligible	Negligible	Minor***	Negligible	Minor***	Reduced dilution capabilities. Orthophosphate concentrations risk increasing due to sensitivities to seasonality and river flow.
Other abstractors	Minor	Minor	Minor	Minor	Minor	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Short term reduced ability to abstract.
Navigation	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Negligible	Negligible	Negligible	Minor	Negligible	Minor	Water levels controlled by locks, tilting gates and weirs. Navigation peaks in summer months, lock operations and demand for water will be higher. Algal blooms and weed choking may impact navigation and reduce aesthetic appearance.
Recreation	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Negligible	Negligible	Negligible	Minor	Negligible	Minor	Increased algal blooms may affect aesthetic quality of the river but are non-permanent.

*Orthophosphate only **Orthophosphate only / Moderate for Dissolved Oxygen % ***Orthophosphate and Dissolved Oxygen %

River Reach	Reach 1		Reach 2		Reach 3		Reach 4		Reach 5		Reach 6		Commentary
Impact	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	**Summer (May-Nov)**	**Winter (Dec-Apr)**	
Macroinvertebrates	Moderate	Moderate	Moderate	Moderate	Minor	Minor	Negligible	Negligible	Negligible	Minor	Negligible	Minor	Reduction in water quality may impact communities via a decrease in sub-optimal habitat.
Fish	Major	Moderate	Moderate	Moderate	Minor	Minor	Negligible	Negligible	Negligible	Minor	Negligible	Minor	Deterioration in water quality may impact fish communities via a decrease in sub-optimal habitat. There is also the potential for increased predation by birds during periods of low flow.
Macrophytes	Moderate	Moderate	Moderate	Moderate	Minor	Minor	Negligible	Negligible	Negligible	Minor	Negligible	Minor	Water quality deterioration may alter community via a decrease in sub-optimal habitat.
Diatoms	Moderate	Moderate	Moderate	Moderate	Minor	Minor	Negligible	Negligible	Negligible	Minor	Negligible	Minor	Water quality deterioration may alter community via a decrease in sub-optimal habitat.

Table 2.3: Monitoring and mitigation measures

Baseline (normal (non-drought) conditions)	• Baseline monitoring to establish baseline environmental conditions, including continuous water quality monitoring at Duston Mill. • Identification of relevant stakeholders. • Encourage business as usual water saving behaviour.
Pre-drought (commence in potential drought)	• Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application. • Additional biological monitoring of macroinvertebrates, macrophytes, fish survey and water quality to supplement baseline monitoring, where required. • Contact all licensed abstractors within the potentially affected area and initiate engagement with key stakeholders. • Regular liaison with the Environment Agency. • Demand management / communications campaigns.
During drought (commence in drought period)	• Frequently monitor flow against temporary drought permit licence and cease abstraction at Duston Mill if flows drop too low. • Enhanced monitoring of water quality and biological communities to quantify the immediate impact of the drought. • Water quality monitoring upstream of Duston Mill, and downstream of Broadhome and Great Billing Water Recycling Centres (WRC). • Continuous monitoring of water levels at South Bridge and Bedford Road Sluice to ensure minimum navigable depth is maintained.
Mitigation measures (commence on implementation of drought permit)	• Variable abstraction at Duston Mill to flush pollutants and prevent stagnation. • Reduce abstraction during busy navigation periods. • Consider dredging, de-silting or weed clearing at known problem locations on the main navigation channel. • Halt abstraction if water quality deteriorates below acceptable levels. • Flow support to backchannels if required.
Post drought (commence after drought permit has been lifted)	• Continued flow monitoring in the River Nene to ensure that drought permit actions are no longer required. • Continued water quality and biological community monitoring to assess the need for continuation of mitigation measures.

2.4 Stakeholder consultation and implementation strategy

2.4.1 Stakeholder consultation

We obtained pre-consultation advice from the Environment Agency on our EAR methodology, as part of the development of the draft Drought Plan 2022. We also obtained statutory consultation advice from the Environment Agency, Natural England, and Historic England on the Strategic Environmental Assessment (SEA) Scoping report. Any concerns have been addressed through the EAR and SEA Environmental Report.

Other relevant stakeholders have been consulted during the Drought Plan 2022 consultation period, with any concerns being addressed for the final Drought Plan. Other stakeholders include:

- The Navigation Authority (Environment Agency)
- Other abstractors
- Recreational user groups
- Other interested parties

No significant concerns are anticipated for this proposed drought permit, as it has been made available for consultation in previous Drought Plans.

For our full drought permit application we would include the following, as recommended by the guidance:

- Written consent from the Environment Agency;
- Comments from those consulted about the application;
- Details of any objections received or agreements reached with objectors;
- A copy of the notices and advertisements relating to our application; and
- A description of our arrangements for the public inspection of the application.

2.4.2 Advertising the application

Our drought permit application would by published in the local newspaper circulating in the area affected by the permit (Northampton Chronicle and Echo). The newspaper also has a website. We would also advertise it in the London Gazette, as recommended by the guidance. We would consider publishing targeted social media updates in line with our communications strategy (**Appendix 10**).

2.4.3 Planning for all outcomes

We plan to engage with relevant stakeholders and address concerns in the creation of our Drought Plan and as part of the consultation process. In the event of a public hearing, we would confirm arrangements closer to the time. We have a number of regional Anglian Water offices which could be used as a venue or we would seek alternative venues or online alternatives as appropriate.

We would liaise closely with the Environment Agency before and during any permit application to ensure we have their support. We have agreed a robust mitigation programme with the Environment Agency and do not anticipate significant issues which may result in a public hearing.

In event of unsuccessful permit we would need to consider other supply-side options, such as rezoning or tankering, as well as increasing demand saving activities.

2.4.4 Drought permit review strategy

We would review our need for a drought permit once we enter potential drought status. This will include updating the data that would be needed to inform a permit. Any changes will be fed back into the EARs as required.

Appendices (on request)

- Draft permit
- Existing abstraction licence - plus a copy of any statutory instrument or local act connected to it or to a discharge permitted by the drought permit

Supporting Information

- **Appendix 7:** Environmental assessment summary
- **Appendix 8:** Environmental monitoring plan

3. River Nene intake (Rutland Water)

3.1 Current licence and proposed drought permit

3.1.1 Current licence

Anglian Water is licenced to abstract from the River Nene for Rutland Water.

Between December and April inclusive, no abstraction must take place if the rate of flow in the River Nene immediately downstream of the authorised point of abstraction is less than a MRF of 125 Ml/d and abstraction would not cause the downstream flow to fall below that rate.

Between May and November inclusive, no abstraction must take place if the rate of flow in the River Nene immediately downstream of the authorised point of abstraction is less than a MRF of 150 Ml/d and abstraction would not cause the downstream flow to fall below that rate.

3.1.2 Proposed drought permit

The following permit application would be made for the River Nene abstraction:

- 50% reduction in the summer and / or winter MRF (from 125 Ml/d to 62.5 Ml/d for December to April and from 150 Ml/d to 75 Ml/d for May to November).

Anglian Water would consider applying for the drought permit if there is a risk of compromising our ability to refill Rutland Water. This is likely to only occur in a severe, multi-season drought. Under the most likely scenario, a winter drought permit would be sought after a dry winter and summer, enabling Anglian Water to refill Rutland Water during the following winter. This typically corresponds to a natural increase in flows (and hence water available for abstraction) and a reduced sensitivity for the majority of potential receptors. We have developed triggers to guide us through the different stages of the drought permit application process, and these are detailed in **Appendix 4**.

In line with current guidance, the drought permit would initially cover a six month period of either October to March (inclusive) for a winter permit or April to September (inclusive) for a summer permit. Subsequent reapplication for a further six months may be considered if required, depending on the drought situation at the time.

This would require a new application and additional environmental assessments. However, AWS consider it is extremely unlikely that it would need to apply for a second six month period, based on analysis carried out for our WRMP 2019, which shows the majority of our supply system is resilient to severe drought (approximately a 1 in 200 year event).

A copy of our current abstraction licence and a draft permit is available on request.

3.2 Justification of the need

3.2.1 Exceptional shortage of rain (ESOR)

For a Drought Order or permit to be granted, there is a legal requirement to demonstrate that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'.

Environment Agency guidance[8] states that it is not appropriate to set a prescriptive approach to assessing the ESOR as each drought and each situation is unique. The guidance provides a range of matters to consider when building the case for ESOR. This section provides an overview of our process for demonstrating an ESOR, following the guidance.

Rainfall is a key indicator in assessing drought conditions. Drought events vary in their duration, the time of year they commence and their magnitude (the extent of the rainfall deficit). Soil moisture conditions respond to precipitation anomalies on a relatively short timescale. Groundwater, streamflow and reservoir storage reflect the longer-term precipitation anomalies. These factors combine to produce a wide range of impacts on water resources.

As such, it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. The following data sources and methods would be used:

Standardised Precipitation Index (SPI)

We use the SPI to indicate the severity of low rainfall and if a drought may be developing. SPI values can be classified as shown in Table 3.1 following McKee et al. (1993)[9]. The World Meteorological Organisation's user guide[10] defines a drought event as occurring any time the SPI is continuously negative, and reaches an intensity of-1.0 or lower. The drought event ends when the SPI becomes positive.

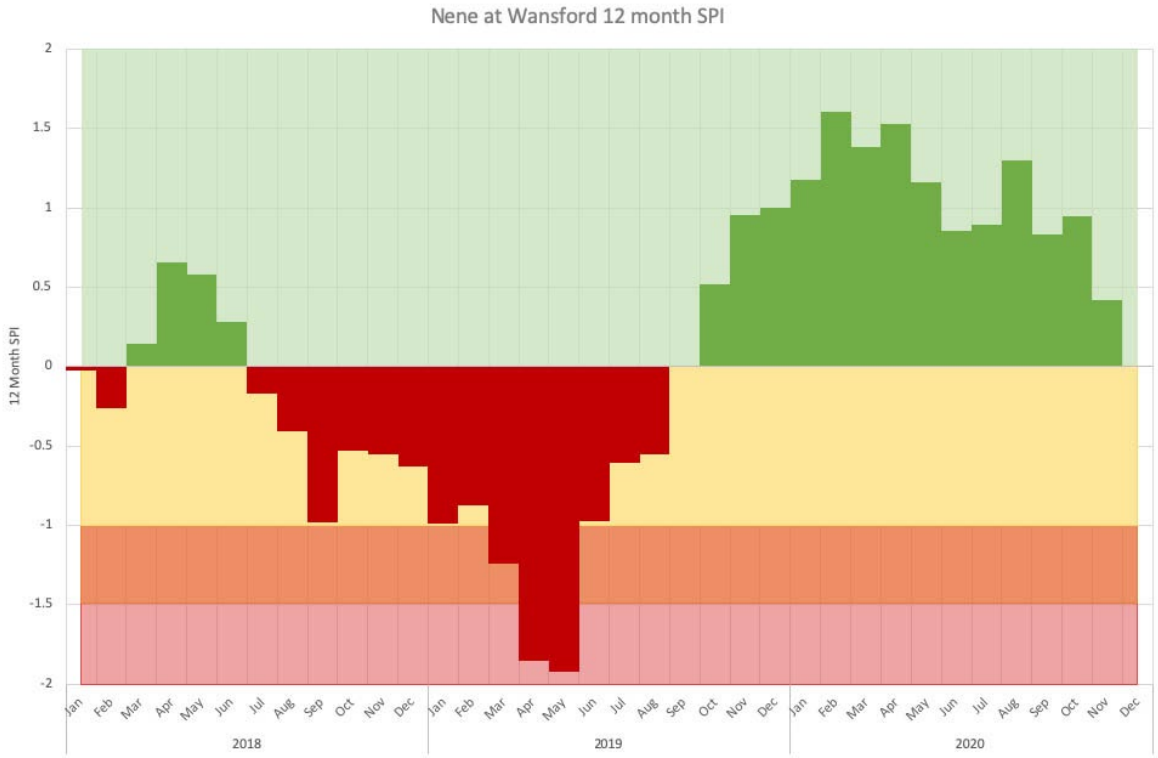
Table 3.1: SPI Values

SPI	Rainfall scenario
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

For the River Nene, rainfall data for the Nene at Wansford catchment is monitored at 1, 6, 12 and 24 month accumulations which allows the pattern and magnitude of longer term rainfall droughts to be measured. We use the 12 month accumulation SPI as an indicator in our drought response framework, and report on SPI as part of our BAU situation monitoring (Figure 3.1).

[8] *EA Drought Planning Guideline: Exceptional shortage of rain*
[9] *McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17-22 January 1993. Boston, American Meteorological Society, 179-184.*
[10] *World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.*

Figure 3.1: 12 month SPI chart for Nene at Wansford



Atkins has carried out analysis of rainfall accumulation of historic and representative stochastically generated droughts at the sub-regional scale for the Anglian Water region[11]. We would compare the pattern and timings of contemporary rainfall accumulations with these historical and stochastic droughts in our assessment.

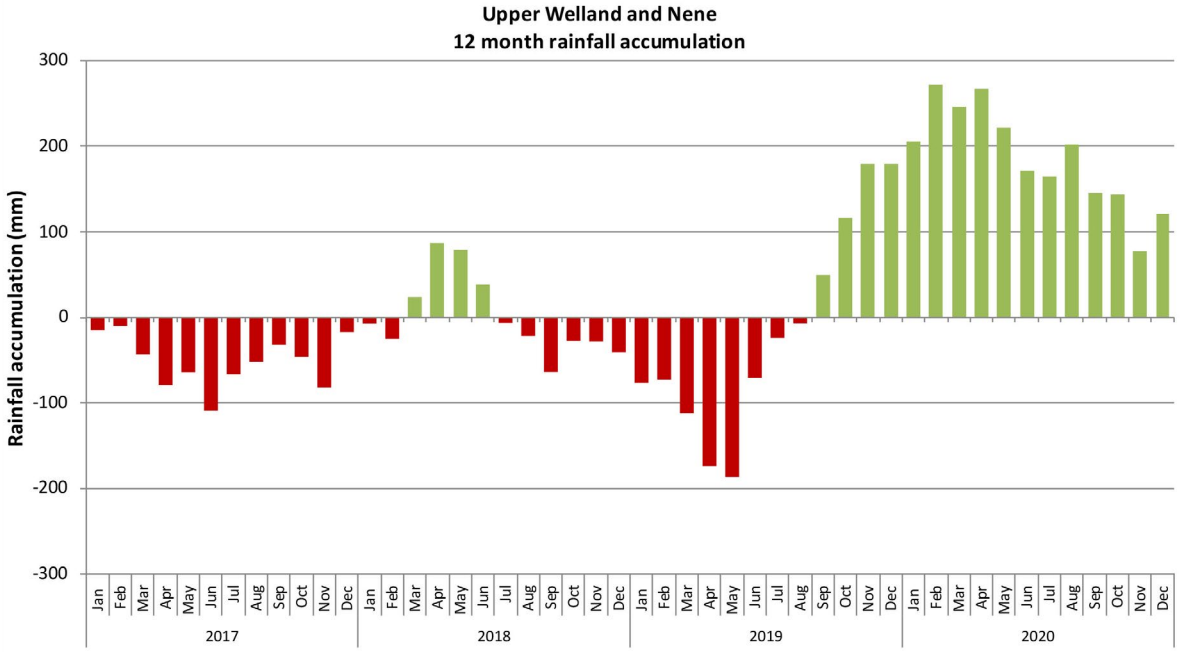
Rainfall ranking

We use the Environment Agency "rainfall by Hydrological Area" categorisations to monitor catchment variation in rainfall distribution. Rainfall data is collated by the Environment Agency from gauges within each hydrological catchment and aggregated for each area. The hydrological area is monitored at 1, 6, 12, 18, 24 and 36 month accumulations, which are then compared to the classifications derived from probability rankings and long term averages for each hydrological area. The probability bandings are derived based on Cunnane's calculations. These rolling rainfall accumulations allow the review of patterns and the magnitude of both annual and longer-term rainfall deficits (e.g. 1 or 2 dry winters) to be measured.

For the River Nene at Wansford, rainfall data for the Upper Welland and Nene hydrological catchment is monitored at 1, 6, 12, 18, 24 and 36 month accumulations and classified as per the probability calculations discussed above. An example of the 12 month rainfall accumulations can be seen in Figure 3.2.

[11] *Drought Selection Process and Criteria - Anglian Water Services (Atkins, 2017)*

Figure 3.2: 12 month rolling rainfall accumulation (mm) departures from the Long Term Average for the Upper Welland and Nene



Other indicators of ESOR

We would support a case for ESOR by presenting other measures, such as soil moisture deficit, effective rainfall, temperature, river flows and groundwater levels (details on these data sources can be found in **Section 2.2, Main Plan**). This would include comparison to the long-term average and trend analysis. We would also describe our current operational water supply situation, to include reservoir storage levels against drought management curves, and forecast projections for a range of rainfall scenarios. Relevant impacts and mitigation actions carried out in the wider supply system would also be detailed.

3.3 Environmental assessment

An environmental assessment of the impact of the drought permit was carried out for the Drought Plan 2022 by Ricardo Energy and Environment, building on the work completed for the Drought Plan 2019 by Mott MacDonald / Atkins. This assesses the potential environmental impacts of implementing the proposed drought action, following Defra and Environment Agency guidance. The findings are detailed in a separate EAR, and summarised in **Appendix 7 and 8**, with a brief overview here.

Significant decreases in flow are expected throughout the seasons, reducing depth, wetted width and size of the channel. Although no water quality impacts were found following the application of the winter drought permit in 2011/12, there is a potential that a more severe drought may lead to water quality impacts, particularly in orthophosphate concentrations. These impacts combined with potential algal blooms may negatively impact upon navigation and ecology, although these impacts can be reduced due to sporadic high flows and temporary phosphate stripping at WRCs.

The report concluded that the potential water quality deterioration, particularly in relation to phosphate concentration, may have a significant effect on some features of the Nene Washes European sites. As such, a HRA Stage II Appropriate Assessment has been carried out, which concluded that robust monitoring protocol and mitigation measures will ensure no adverse effects on the integrity of the site.

The key findings of the environmental assessment are summarised in Table 3.2.

Table 3.3 shows baseline, pre-drought, during drought, mitigation measures and post drought surveys for the proposed drought action at Wansford.

Table 3.2: Summary of environmental impacts of proposed drought permit in the River Nene (Rutland Water)

River Reach / Impact	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 2 Predicted Impact Summer	Reach 2 Predicted Impact Winter	Commentary
Hydrology (Level and flow)	Major	Major	Major	Major	Significant decreases in flow are expected throughout the seasons, reducing depth, wetted width and size of the channel.
Geomorphology	Moderate	Major	Moderate	Major	During summer sediment transport will be significantly affected whilst in winter geomorphological processes and sediment transport capacity will be significantly altered as a result of reductions in flow.
Water Quality	Major*	Major*	Major*	Major*	Risk of deterioration of orthophosphate is high in all seasons due to sensitivity to changes in river flow.
Other abstractors	Moderate	Minor	Major	Moderate	Reduced flows may have major impacts on abstractors.
Navigation	Moderate	Moderate	Moderate	Moderate	Water levels should be maintained in both winter and summer, meaning navigation should remain functional, however risk of river choking through algal blooms in summer is high. Lock usage may be limited in summer to maintain levels.
Recreation	Moderate	Moderate	Moderate	Moderate	There is potential for impacts on the visual appearance of the river, through algal blooms and reduced flows to be impacted.
Macroinvertebrates	Major	Major	Major	Major	Reduced water quality flows and level may impact the macroinvertebrate community over the duration. Reduced habitat availability for macroinvertebrates may reduce the diversity of the community.
Fish	Major	Major	Major	Major	Reduced flows, level and subsequently wetted width may reduce availability of habitats for fish. Secondary effects include reduction in water quality which could further reduce availability of habitat. Increased potential for settlement of fine sediments as a result of decreased river flow. Increased risk of predation during periods of low flow.
Macrophytes	Moderate	Moderate	Moderate	Moderate	Impact on macrophyte species in the reach is considered moderate as a result of reduced habitat availability. Potential impacts are likely to include a loss of marginal macrophyte species, loss of or reduction in the abundance of flow-sensitive species, reduction in gaseous exchange in submerged species due to slower flow or increased epiphytic algae cover, encroachment of terrestrial emergent species into the channel, and smothering of in-channel plant species (although this would be worst case scenario).
Diatoms	Moderate	Moderate	Moderate	Moderate	Reducing flows may increase the levels of sedimentation within the watercourse, resulting in a reduction in light availability from the baseline conditions.

*Orthophosphate only

Table 3.3: Monitoring and mitigation measures

Baseline (normal (non-drought) conditions)	• Baseline monitoring to establish baseline environmental conditions. • Identification of relevant stakeholders. • Encourage business as usual water saving behaviour.
Pre-drought (commence in potential drought)	• Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application. • Additional biological monitoring of macroinvertebrates, macrophytes, fish survey and water quality to supplement baseline monitoring, where required. • Contact all licensed abstractors within the potentially affected area and initiate engagement with key stakeholders. • Regular liaison with the Environment Agency. • Demand management / communications campaigns.
During drought (commence in drought period)	• Frequently monitor flow against temporary drought permit licence and cease abstraction at Wansford if flows drop too low. • Enhanced monitoring of water quality and biological communities to quantify the immediate impact of the drought . • Abstraction to be halted if water quality deteriorates below acceptable levels, or if water levels are affected by greater than expected amounts. • Records of daily abstraction quantities and flow submitted weekly to the Environment Agency.
Mitigation measures (commence on implementation of drought permit)	• Variable abstraction at Wansford according to downstream demands. • Reduce abstraction during busy navigation periods. • Consider dredging, de-silting or weed clearing at known problem locations on the main navigation channel. • Halt abstraction if lock operation is compromised or water quality deteriorates below acceptable levels. • Flow support to neighbouring channels if required. • Temporary phosphate stripping at WRCs, for example Wittering and Stibbington.
Post drought (commence after drought permit has been lifted)	• Continued flow monitoring in the River Nene to ensure that drought permit actions are no longer required. • Continued water quality and biological community monitoring to assess the need for continuation of mitigation measures.

3.4 Stakeholder consultation and implementation strategy

3.4.1 Stakeholder consultation

We obtained pre-consultation advice from the Environment Agency on our EAR methodology, as part of the development of the draft Drought Plan 2022. We also obtained statutory consultation advice from the Environment Agency, Natural England, and Historic England on the SEA Scoping report. Any concerns have been addressed through the EAR and SEA Environmental Report.

Other relevant stakeholders have been consulted during the Drought Plan 2022 consultation period, with any concerns being addressed for the final Drought Plan. Other stakeholders include:

- The Navigation Authority (Environment Agency)
- Other abstractors
- Recreational user groups
- Other interested parties

During the implementation of the 2011/12 drought permit, the Angling Trust Regional Forum raised concerns about potential impacts on angling locations. Concerns were addressed at the time via a hydraulic survey, and communication should be carried out in the event of a permit application to ensure that this is still the case.

No significant concerns are anticipated for this proposed drought permit, as it has been made available for consultation in previous Drought Plans.

For our full drought permit application we would include the following, as recommended by the guidance:

- Written consent from the Environment Agency;
- Comments from those consulted about the application;
- Details of any objections received or agreements reached with objectors;
- A copy of the notices and advertisements relating to our application; and
- A description of our arrangements for the public inspection of the application.

3.4.2 Advertising the application

Our drought permit application would by published in the local newspaper circulating in the area affected by the permit (Peterborough Telegraph (circulation 22,581[12])). The newspaper also has a website. We would also advertise it in the London Gazette, as recommended by the guidance. We would consider publishing targeted social media updates in line with our communications strategy (**Appendix 10**).

3.4.3 Planning for all outcomes

We plan to engage with relevant stakeholders and address concerns in the creation of our Drought Plan and as part of the consultation process. In the event of a public hearing, we would confirm arrangements closer to the time. We have a number of regional Anglian Water offices which could be used as a venue or we would seek alternative venues or online alternatives as appropriate.

We would liaise closely with the Environment Agency before and during any permit application to ensure we have their support. We have agreed a robust mitigation programme with the Environment Agency and do not anticipate significant issues which may result in a public hearing.

In event of unsuccessful permit we would need to consider other supply-side options, such as rezoning or tankering, as well as increasing demand saving activities.

3.4.4 Drought permit review strategy

We would review our need for a drought permit once we enter potential drought status. This will include updating the data that would be needed to inform a permit. Any changes will be fed back into the EARs as required.

Appendices (on request)

- Draft permit
- Existing abstraction licence - plus a copy of any statutory instrument or local act connected to it or to a discharge permitted by the drought permit

Supporting Information

- **Appendix 7:** Environmental assessment summary
- **Appendix 8:** Environmental monitoring plan

[12] *https://www.abc.org.uk/product/18629 (June ,2018)*

4. River Great Ouse intake (Grafham Water)

4.1 Current licence and proposed drought permit

4.1.1 Current licence

Anglian Water is licenced to abstract from the River Great Ouse for Grafham Water.

The licence is subject to the following conditions:

- Abstraction may only take place when the water level in the River Great Ouse (as measured at the gauge board upstream of the Offord Sluice) is equal to or greater than 11.05 m above Ordnance Datum.
- No abstraction must take place when the net flow in the River Great Ouse at Offord Sluice is equal to or less than 136.4 Ml/d (the Minimum Residual Flow (MRF)). Abstraction is permissible for 75% of flow in excess of the MRF.
- During the period 1 June to 30 September each year if the sum of the average rate of net flow in the River Great Ouse at Offord Sluice, during the weekly period expiring at 9am (Greenwich Mean Time) on Friday and beginning at 9am on the previous Friday (being the average in the weekly period of the rate of flow at Offord), is less than 227,305 m^3 per day then no water shall be abstracted during the following weekend.

4.1.2 Proposed drought permit

The permit application would be considered for the River Great Ouse abstraction in the following two stages:

- Stage 1: Existing MRF, abstraction at up to 100% of the flow in excess of the MRF
- Stage 2: 50% reduction MRF to 68 Ml/d, abstraction at up to 75% of the flow excess of the MRF

Stage 2 allows greater abstraction than Stage 1 when the flow is below 340 Ml/d, so would be likely to be applied for in the later stages of a drought.

Usage would be expected to revert to Stage 1 when sufficient flow recovery has occurred. It has been assumed that instantaneous, hourly, daily and annual totals would remain unchanged from those currently licenced.

Anglian Water would be likely to consider applying for the drought permit in a severe, possibly multi-season, drought, if there is a risk of compromising our ability to refill Grafham Water.

Under the most likely scenario, a winter drought permit would be sought after a dry winter and summer, enabling Anglian Water to refill Grafham Water during the following winter. This typically corresponds to a natural increase in flows (and hence water available for abstraction) and a reduction in the sensitivity of physico-chemical and biological receptors to impact.

In line with current guidance, the drought permit would initially cover a six month period of either October to March (inclusive) for a winter permit or April to September (inclusive) for a summer permit. Subsequent reapplication for a further six months may be considered if required, depending on the drought situation at the time.

This would require a new application and additional environmental assessments. However, AWS consider it is extremely unlikely that it would need to apply for a second six month period, based on analysis carried out for our WRMP 2019, which shows the majority of our supply system is resilient to severe drought (approximately a 1 in 200 year event).

We have developed triggers to guide us through the different stages of the drought permit application process, and these are detailed in **Appendix 4**.

A copy of our current abstraction licence and a draft permit is available on request.

4.2. Justification of the need

4.2.1 Exceptional shortage of rain (ESOR)

For a Drought Order or permit to be granted, there is a legal requirement to demonstrate that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'.

Environment Agency guidance[13] states that it is not appropriate to set a prescriptive approach to assessing the ESOR as each drought and each situation is unique. The guidance provides a range of matters to consider when building the case for ESOR. This section provides an overview of our process for demonstrating an ESOR, following the guidance.

Rainfall is a key indicator in assessing drought conditions. Drought events vary in their duration, the time of year they commence and their magnitude (the extent of the rainfall deficit). Soil moisture conditions respond to precipitation anomalies on a relatively short timescale. Groundwater, streamflow and reservoir storage reflect the longer-term precipitation anomalies. These factors combine to produce a wide range of impacts on water resources.

As such, it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. The following data sources and methods would be used:

Standardised Precipitation Index (SPI)

We use the SPI to indicate the severity of low rainfall and if a drought may be developing. SPI values can be classified as shown in Table 4.1 following McKee et al. (1993)[14]. The World Meteorological Organisation's user guide[15] defines a drought event as occurring any time the SPI is continuously negative and reaches an intensity of-1.0 or lower. The drought event ends when the SPI becomes positive.

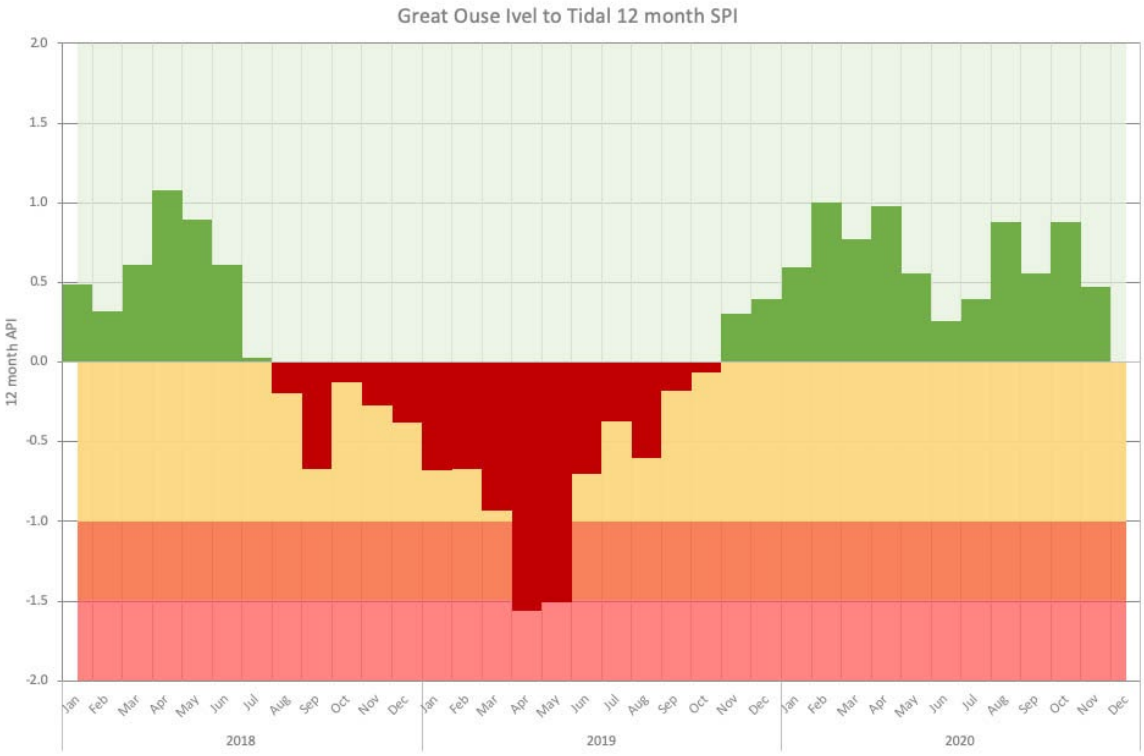
Table 4.1: SPI Values

SPI	Rainfall scenario
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

For the River Great Ouse, rainfall data for the Great Ouse Ivel to Tidal catchment is monitored at 1, 6, 12 and 24 month accumulations which allows the pattern and magnitude of longer term rainfall droughts to be measured. We use the 12 month accumulation SPI as an indicator in our drought response framework, and report on SPI as part of our BAU situation monitoring (Figure 4.1).

[13] *EA Drought Planning Guideline: Exceptional shortage of rain*
[14] *McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17-22 January 1993. Boston, American Meteorological Society, 179-184.*
[15] *World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.*

Figure 4.1: 12 month SPI chart for Great Ouse Ivel to Tidal



Atkins has carried out analysis of rainfall accumulation of historic and representative stochastically generated droughts at the sub-regional scale for the Anglian Water region[16]. We would compare the pattern and timings of contemporary rainfall accumulations with these historical and stochastic droughts in our assessment.

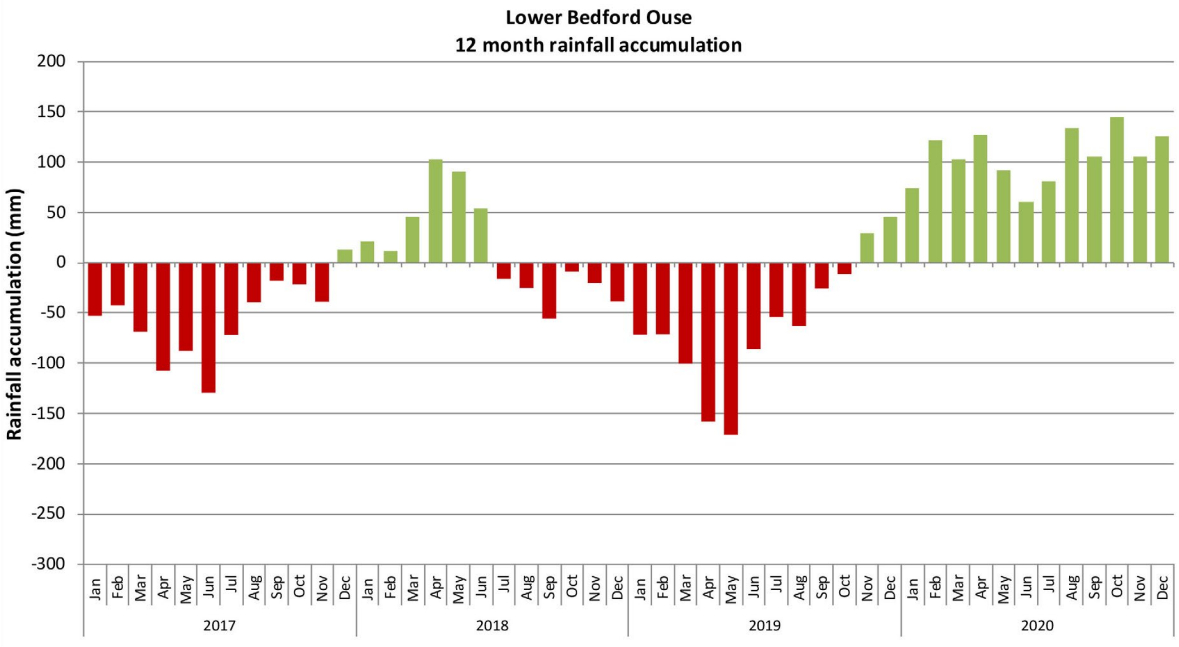
Rainfall ranking

We use the Environment Agency "rainfall by Hydrological Area" categorisations to monitor catchment variation in rainfall distribution. Rainfall data is collated by the Environment Agency from gauges within each hydrological catchment and aggregated for each area. The hydrological area is monitored at 1, 6, 12, 18, 24 and 36 month accumulations, which are then compared to the classifications derived from probability rankings and long term averages for each hydrological area. The probability bandings are derived based on Cunnane's calculations. These rolling rainfall accumulations allow the review of patterns and the magnitude of both annual and longer-term rainfall deficits (e.g. 1 or 2 dry winters) to be measured.

For the River Great Ouse, rainfall data for the Lower Bedford Ouse hydrological catchment is monitored at 1, 6, 12, 18, 24 and 36 month accumulations and classified as per the probability calculations discussed above. An example of the 12 month rainfall accumulations can be seen in Figure 4.2. We would also review the Upper Bedford Ouse hydrological catchment in conjunction.

[16] *Drought Selection Process and Criteria - Anglian Water Services (Atkins, 2017)*

Figure 4.2: 12 month rolling rainfall accumulation (mm) departures from the Long Term Average for the Lower Bedford Ouse



Other indicators of ESOR

We would support a case for ESOR by presenting other measures, such as soil moisture deficit, effective rainfall, temperature, river flows and groundwater levels (details on these data sources can be found in **Section 2.2, Main Plan**). This would include comparison to the long-term average and trend analysis. We would also describe our current operational water supply situation, to include reservoir storage levels against drought management curves, and forecast projections for a range of rainfall scenarios. Relevant impacts and mitigation actions carried out in the wider supply system would also be detailed.

4.3 Environmental assessment

An environmental assessment of the impact of the drought permit was carried out for the Drought Plan 2022 by Ricardo Energy and Environment, building on the work completed for the Drought Plan 2019 by Mott MacDonald / Atkins. This assesses the potential environmental impacts of implementing the proposed drought action, following Defra and Environment Agency guidance. The findings are detailed in a separate EAR, and summarised in **Appendix 7 and 8**, with a brief overview here.

A reduction in flow of up to 32% in a Stage 2 permit and 20% for a Stage 1 permit may result in minor impacts to river flow and levels, and water quality. There is a risk of a temporary reduction in WFD status. Navigation and recreation impacts are perceived to be greater in the summer. Detrimental effects on water quality may exert pressure on fish and macrophytes, and cause algal blooms. However, these impacts will be reduced by the higher flows in the recovery period which will help to reduce nutrient and pollutant concentration.

The report concluded that there is potential for likely significant effects on the Ouse Washes European sites due to water quality deterioration. As such, a HRA Stage II Appropriate Assessment has been carried out, which concluded that robust monitoring protocol and mitigation measures will ensure no adverse effects on the integrity of the site.

The key findings of the environmental assessment are summarised in Table 4.2 and Table 4.3.

Table 4.4 shows baseline, pre-drought, during drought, mitigation measures and post drought surveys for the proposed drought action at Offord.

Table 4.2: Summary of environmental impacts of proposed Stage 1 drought permit in the River Great Ouse

River Reach / Impact	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 2 Predicted Impact Summer	Reach 2 Predicted Impact Winter	Commentary
Hydrology (Level and flow)	Minor	Moderate	Minor	Minor	Implementation of the drought permit causes more adverse impacts during summer months.
Geomorphology	Minor	Minor	Minor	Minor	Reductions in flow risk negatively impacting sediment transport and capacity within the reaches.
Water Quality	Minor (all)	Moderate* Minor**	Minor***	Minor***	Orthophosphate and Ammonia concentrations risk increasing to a level that has potential to impact the WFD status.
Other abstractors	Negligible	Negligible	Moderate	Negligible	No perceived significant impacts on other abstractors.
Navigation	Minor	Minor	Major	Minor	Water levels controlled by locks, tilting gates and weirs. Navigation reduces during winter meaning Environment Agency's ability to maintain the navigation retention level of 11.12 mAOD should increase. Navigation peaks in summer months, lock operations and demand for water will be higher. The impacts will be location dependent. Navigation will not be affected around Hermitage Lock.
Recreation	Minor	Minor	Moderate	Minor	Some minor impacts. The river is more popular in summer months.
Macroinvertebrates	Minor	Minor	Minor	Minor	Reduction in water quality may impact communities and rare species. Stagnation in backchannels could be significant in summer, though flows may not decrease substantially.
Fish	Minor	Moderate	Minor	Minor	Deterioration in water quality may impact fish communities. Effects are more pronounced in summer.
Macrophytes	Minor	Minor	Minor	Minor	Prolonged reduction in flows may impact macrophyte communities.
Diatoms	Minor	Minor	Minor	Minor	Algal blooms possible risk in summer.

*Orthophosphate only **Ammonia and DO ***Orthophosphate and ammonia

Table 4.3: Summary of environmental impacts of proposed Stage 2 drought permit in the River Great Ouse

River Reach / Impact	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 2 Predicted Impact Summer	Reach 2 Predicted Impact Winter	Commentary
Hydrology (Level and flow)	Major	Moderate	Major	Minor	Implementation of the drought permit causes more adverse impacts during summer months.
Geomorphology	Moderate	Minor	Moderate	Minor	Reductions in flow risk negatively impacting sediment transport and capacity within the reaches.
Water Quality	Major* Minor**	Minor (all)	Major* Minor**	Minor***	Orthophosphate and Ammonia concentrations risk increasing to a level that has potential to impact the WFD status.
Other abstractors	Negligible	Negligible	Moderate	Minor	No perceived significant impacts on other abstractors.
Navigation	Minor	Minor	Major	Minor	Water levels controlled by locks, tilting gates and weirs. Navigation reduces during winter meaning Environment Agency's ability to maintain the navigation retention level of 11.12 mAOD should increase. Navigation peaks in summer months, lock operations and demand for water will be higher. The impacts will be location dependent. Navigation will not be affected around Hermitage Lock.
Recreation	Minor	Minor	Moderate	Minor	Some minor impacts. The river is more popular in summer months.
Macroinvertebrates	Moderate	Minor	Moderate	Minor	Reduction in water quality may impact communities and rare species. Stagnation in backchannels could be significant in summer, though flows may not decrease substantially.
Fish	Major	Moderate	Moderate	Minor	Deterioration in water quality may impact fish communities. Effects are more pronounced in summer.
Macrophytes	Moderate	Minor	Moderate	Minor	Prolonged reduction in flows may impact macrophyte communities.
Diatoms	Moderate	Minor	Moderate	Minor	Algal blooms possible risk in summer.

*Orthophosphate only **Ammonia and DO ***Orthophosphate and ammonia

Table 4.4: Monitoring and mitigation measures

Baseline (normal (non-drought) conditions)	• Baseline monitoring to establish baseline environmental conditions. • Identification of relevant stakeholders. • Encourage business as usual water saving behaviour.
Pre-drought (commence in potential drought)	• Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application, including spot flow gauging at key sites along the River Great Ouse. • Additional biological monitoring of macroinvertebrates, macrophytes, fish survey and water quality to supplement baseline monitoring, where required. • Contact all licensed abstractors within the potentially affected area, and initiate engagement with key stakeholders including navigational and recreational users. • Regular liaison with the Environment Agency. • Demand management / communications campaigns.
During drought (commence in drought period)	• Frequently monitor flow against temporary drought permit licence and cease abstraction at Offord if flows drop too low. • Enhanced monitoring of water quality and biological communities to quantify the immediate impact of the drought.
Mitigation measures (commence on implementation of drought permit)	• Reduce or cease abstraction should lock operation become compromised. • Variable abstraction to allow occasional flushing of pollutants and prevent stagnation. • Phosphate removal at WRCs, for example Huntingdon and Cotton Valley. Ammonia removal at larger WRCs should also be considered. • Weed clearance or dredging if required. • Bubblers to enhance dissolved oxygen (last resort option). • Pump water into stranded backchannels (last resort option). • Should fish become stranded, a relocation plan could be considered (last resort option). • Coordination with stakeholders particularly residential and navigational users (signage, navigation notices).
Post drought (commence after drought permit has been lifted)	• Continued flow monitoring in the River Great Ouse to ensure that drought permit actions are no longer required. • Continued water quality and biological community monitoring to evaluate recovery and to assess the need for continuation of mitigation measures.

4.4 Stakeholder consultation and implementation strategy

4.4.1 Stakeholder consultation

We obtained pre-consultation advice from the Environment Agency on our EAR methodology, as part of the development of the draft Drought Plan 2022. We also obtained statutory consultation advice from the Environment Agency, Natural England, and Historic England on the SEA Scoping report. Any concerns have been addressed through the EAR and SEA Environmental Report.

Other relevant stakeholders have been consulted during the Drought Plan 2022 consultation period, with any concerns being addressed for the final Drought Plan. Other stakeholders include:

- The Navigation Authority (Environment Agency)
- Other abstractors
- Recreational user groups
- Other interested parties

No significant concerns are anticipated for this proposed drought permit, as it has been made available for consultation in previous Drought Plans.

For our full drought permit application we would include the following, as recommended by the guidance:

- Written consent from the Environment Agency;
- Comments from those consulted about the application;
- Details of any objections received or agreements reached with objectors;
- A copy of the notices and advertisements relating to our application; and
- A description of our arrangements for the public inspection of the application.

4.4.2 Advertising the application

Our drought permit application would by published in the daily local newspaper circulating in the area affected by the permit (Cambridgeshire News (circulation 8005[17]) and The Hunts Post). The newspaper also has a website. We would also advertise it in the London Gazette, as recommended by the guidance. We would consider publishing targeted social media updates in line with our communications strategy (**Appendix 10**).

4.4.3 Planning for all outcomes

We plan to engage with relevant stakeholders and address concerns in the creation of our Drought Plan and as part of the consultation process. In the event of a public hearing, we would confirm arrangements closer to the time. We have a number of regional Anglian Water offices which could be used as a venue or we would seek alternative venues or online alternatives as appropriate.

We would liaise closely with the Environment Agency before and during any permit application to ensure we have their support. We have agreed a robust mitigation programme with the Environment Agency and do not anticipate significant issues which may result in a public hearing.

In event of unsuccessful permit we would need to consider other supply-side options, such as rezoning or tankering, as well as increasing demand saving activities.

4.4.4 Drought permit review strategy

We would review our need for a drought permit once we enter potential drought status. This will include updating the data that would be needed to inform a permit. Any changes will be fed back into the EARs as required.

Appendices (on request)

- Draft permit
- Existing abstraction licence - plus a copy of any statutory instrument or local act connected to it or to a discharge permitted by the drought permit

Supporting Information

- **Appendix 7:** Environmental assessment summary
- **Appendix 8:** Environmental monitoring plan

[17] *https://www.abc.org.uk/product/9730 (June ,2018)*

5. Alton Water

5.1 Proposed drought permit options review and new strategy

We previously included details of a drought permit which proposed a 50% reduction in the MRF immediately downstream of the intake to help refill Alton Water during drought conditions.

The Environment Agency have made it clear that additional abstractions from these waterbodies, which are already heavily impacted by agriculture and water sector, is less than desirable. Following detailed yield analysis at Alton Water, it is determined that the reservoir is constrained in output by the current 5-year abstraction licence that dictates the volume of water able to drawn from the reservoir itself. The River Gipping has an almost equally constraining 5-year abstraction licence associated with the Anglian Water abstraction point. As a result of these constraints, Alton Water would not benefit from the proposed permit option detailed above from a reservoir yield perspective. The only benefit would be in maintaining reservoir levels to a higher level, at the expense of the level of river flows that would ultimately discharge into the Orwell estuary - a designated RAMSAR, SPA and SSSI site.

Given the lack of surface water options available within a drought, the groundwater sources in the East Suffolk Water Resource Zone (WRZ) have been assessed to understand any potential supply benefits from increased abstraction of the aquifer. We are expecting capping of annual abstraction licences on all of our groundwater sources in the WRZ, as well as sustainability reductions from ongoing WINEP investigations by the end of the current AMP. Therefore, any increases in groundwater abstraction that would result in a material benefit to supply would be much higher than currently being proposed under the licence capping proposals, and therefore extremely undesirable from a regulatory perspective.

Given the above, Anglian Water has deemed the previously proposed drought permit redundant from a water resource perspective and unacceptable from an environmental perspective. Furthermore, exploration of alternative drought permit options has determined no other viable measures. Anglian Water's proposed strategic grid will provide greater resilience to drought events once planned construction is completely in the next AMP. For the current situation, Alton will rely on demand management options and other extreme drought supply actions, such as road tankering.

6. River Colne augmentation (Ardleigh Reservoir)

6.1 Current licence and proposed drought permit

6.1.1 Current licence

Our current licence for the Lower Colne allows us to abstract from the Aldham, Balkerne and Cook's Mill groundwater sources, and discharge it to the River Colne in order to augment the flow at the East Mill intake.

A total combined quantity of 10,000 Ml of water can be abstracted from the groundwater sources over a five-year period. In addition, there are also conditions on maximum quantities which can be abstracted in any 24-hour period (6 Ml/d each at Aldham, Balkerne and Cook's Mill), and an instantaneous rate not exceeding 70 l/s.

An additional condition on the licence is that no more than 34,095 Ml in aggregate can be abstracted between April and September during any five-year period.

The abstraction licence includes water quality conditions to restrict discharge into the River Colne when quality is poor (based on concentrations of chloride, sodium and iron and temperature). Aeration of the abstracted water is required prior to discharge.

6.1.2 Proposed drought permit

The following permit application would be made for the Lower Colne groundwater sources:

- Temporarily increase the licenced abstraction at the Aldham and Balkerne groundwater sources by 3 Ml/d each to provide additional augmentation to the River Colne. This would increase the total daily potential augmentation from these groundwater sources from 12 to 18 Ml/d.

There would be no change to the aggregate quantity of water that can be abstracted in a five-year period.

It is assumed that augmentation would cease when flows are higher than the maximum abstraction at East Mills. Therefore, when flows are higher than 36 Ml/d, baseline augmentation and thus drought permit abstraction would not be implemented.

In line with current guidance, the drought permit would initially cover a six month period of either October to March (inclusive) for a winter permit or April to September (inclusive) for a summer permit. Subsequent reapplication for a further six months may be considered if required, depending on the drought situation at the time.

This would require a new application and additional environmental assessments. However, AWS consider it is extremely unlikely that it would need to apply for a second six month period, based on analysis carried out for our WRMP 2019, which shows the majority of our supply system is resilient to severe drought (approximately a 1 in 200 year event).

We have developed triggers to guide us through the different stages of the drought permit application process, and these are detailed in **Appendix 4**.

A copy of our current abstraction licence and a draft permit application is available on request.

6.2 Justification of the need

6.2.1 Exceptional shortage of rain (ESOR)

For a Drought Order or permit to be granted, there is a legal requirement to demonstrate that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'.

Environment Agency guidance[18] states that it is not appropriate to set a prescriptive approach to assessing the ESOR as each drought and each situation is unique. The guidance provides a range of matters to consider when building the case for ESOR. This section provides an overview of our process for demonstrating an ESOR, following the guidance.

Rainfall is a key indicator in assessing drought conditions. Drought events vary in their duration, the time of year they commence and their magnitude (the extent of the rainfall deficit). Soil moisture conditions respond to precipitation anomalies on a relatively short timescale. Groundwater, streamflow and reservoir storage reflect the longer-term precipitation anomalies. These factors combine to produce a wide range of impacts on water resources.

As such, it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. The following data sources and methods would be used:

Standardised Precipitation Index (SPI)

We use the SPI to indicate the severity of low rainfall and if a drought may be developing. SPI values can be classified as shown in Table 6.1 following McKee et al. (1993)[19]. The World Meteorological Organisation's user guide[20] defines a drought event as occurring any time the SPI is continuously negative and reaches an intensity of-1.0 or lower. The drought event ends when the SPI becomes positive.

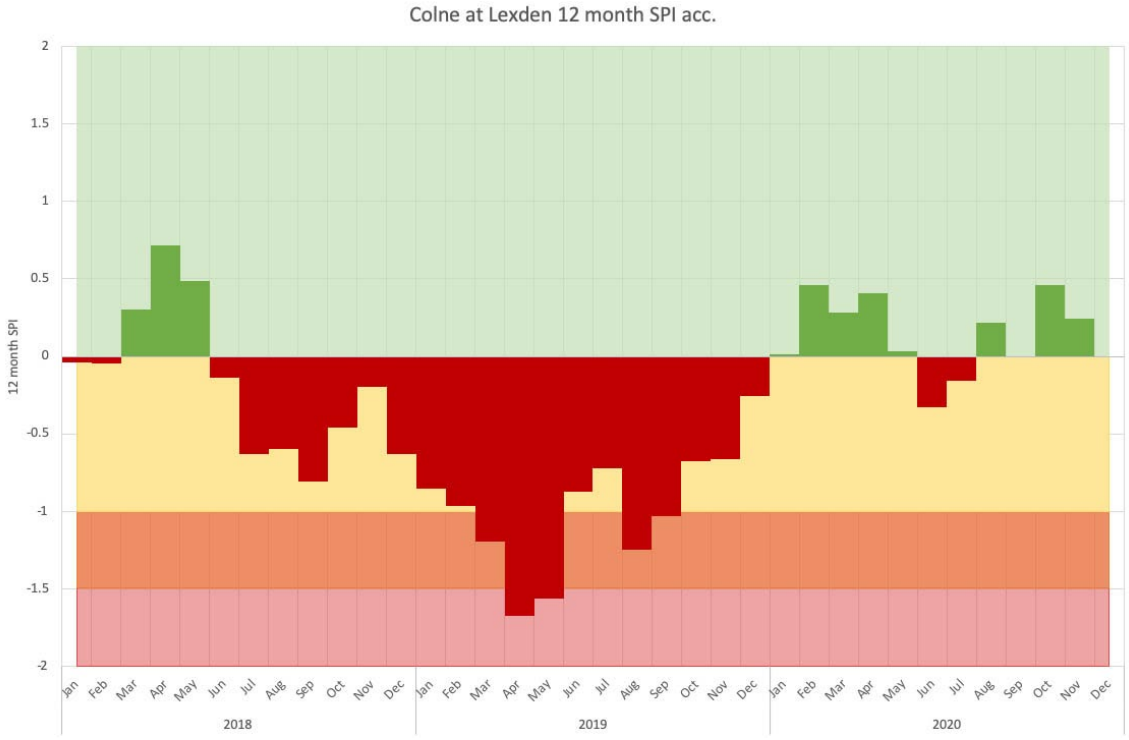
Table 6.1: SPI Values

SPI	Rainfall scenario
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

For the River Colne, rainfall data for the Colne at Lexden catchment is monitored at 1, 6, 12 and 24 month accumulations which allows the pattern and magnitude of longer term rainfall droughts to be measured. We use the 12 month accumulation SPI as an indicator in our drought response framework, and report on SPI as part of our BAU situation monitoring (Figure 6.1).

[18] *EA Drought Planning Guideline: Exceptional shortage of rain*
[19] *McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17-22 January 1993. Boston, American Meteorological Society, 179-184.*
[20] *World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.*

Figure 6.1: 12 month SPI chart for Colne at Lexden



Atkins has carried out analysis of rainfall accumulation of historic and representative stochastically generated droughts at the sub-regional scale for the Anglian Water region[21]. We would compare the pattern and timings of contemporary rainfall accumulations with these historical and stochastic droughts in our assessment.

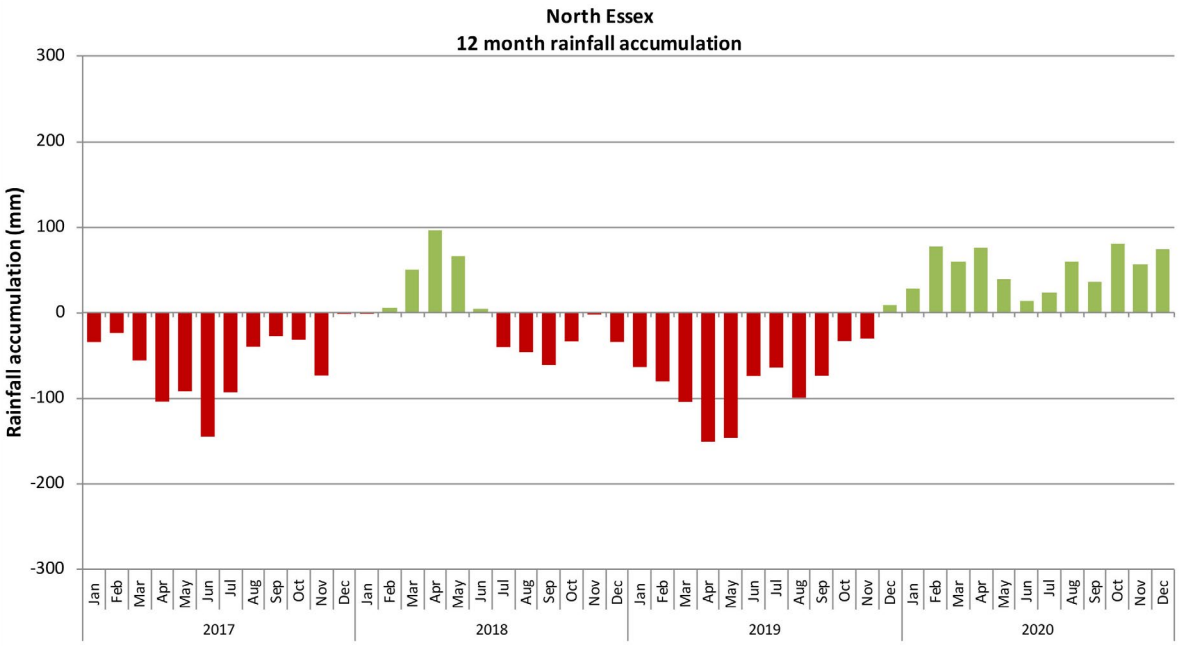
Rainfall ranking

We use the Environment Agency "rainfall by Hydrological Area" categorisations to monitor catchment variation in rainfall distribution. Rainfall data is collated by the Environment Agency from gauges within each hydrological catchment and aggregated for each area. The hydrological area is monitored at 1, 6, 12, 18, 24 and 36 month accumulations, which are then compared to the classifications derived from probability rankings and long term averages for each hydrological area. The probability bandings are derived based on Cunnane's calculations. These rolling rainfall accumulations allow the review of patterns and the magnitude of both annual and longer-term rainfall deficits (e.g. 1 or 2 dry winters) to be measured.

For the River Colne, rainfall data for the North Essex hydrological catchment is monitored at 1, 6, 12, 18, 24 and 36 month accumulations and classified as per the probability calculations discussed above. An example of the 12 month rainfall accumulations can be seen in Figure 6.2.

[21] *Drought Selection Process and Criteria - Anglian Water Services (Atkins, 2017)*

Figure 6.2: 12 month rolling rainfall accumulation (mm) departures from the Long Term Average for North Essex



Other indicators of ESOR

We would support a case for ESOR by presenting other measures, such as soil moisture deficit, effective rainfall, temperature, river flows and groundwater levels (details on these data sources can be found in **Section 2.2, Main Plan**). This would include comparison to the long-term average and trend analysis. We would also describe our current operational water supply situation, to include reservoir storage levels against drought management curves, and forecast projections for a range of rainfall scenarios. Relevant impacts and mitigation actions carried out in the wider supply system would also be detailed.

6.3 Environmental assessment

An environmental assessment of the impact of the drought permit was carried out for the Drought Plan 2022 by Ricardo Energy and Environment, building on the work completed for the Drought Plan 2019 by Mott MacDonald / Atkins. This assesses the potential environmental impacts of implementing the proposed drought action, following Defra and Environment Agency guidance. The findings are detailed in a separate EAR, and summarised in **Appendix 7 and 8**, with a brief overview here.

The assessment concluded that the proposed drought action will only have a localised impact. The impact upon the River Colne is assessed to be positive and minimal, and there are no mechanisms by which significant effects on European sites will occur. A 0.2 m drawdown is predicted within a 3 km radius, and hence there is a small possibility of impact upon 14 other groundwater abstractors. These abstractors will be contacted and the potential for impact will be confirmed, along with any required mitigation measures, prior to the application for a drought permit. Flow data indicates that the need for a drought permit for the River Colne intake would be short and infrequent.

The HRA Stage I: Screening Assessment concluded that there are no likely significant effects of the proposed drought permit upon European designated sites.

The key findings of the environmental assessment are summarised in Table 6.2.

Table 6.3 shows baseline, pre-drought, during drought, mitigation measures and post drought surveys for the proposed drought action at the River Colne.

Table 6.2: Summary of environmental impacts of proposed drought permit in the River Colne

River Reach / Impact	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 2 Predicted Impact Summer	Reach 2 Predicted Impact Winter	Reach 3 Predicted Impact Summer	Reach 3 Predicted Impact Winter	Commentary
Hydrology (Level and flow)	Negligible	Negligible	Minor	Minor	Negligible	Negligible	Although the augmentation has a positive impact on flow within Reach 2 intake, it does not appear that the augmentation makes a significant difference.
Geomorphology	Negligible	Negligible	Minor	Minor	Negligible	Negligible	Potential for increased sediment transport and erosion within Reach 2.
Water Quality	Negligible	Negligible	Minor*	Minor*	Negligible	Negligible	Potential for orthophosphate to be negatively impacted within Reach 2 as a result of sensitivity to changes in river flow.
Other abstractors	Negligible	Negligible	Moderate**	Moderate**	Negligible	Negligible	Fourteen groundwater abstraction licences fall within the radius of influence, and it is possible that these abstractors may be adversely impacted by the drought action.
Navigation	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	The River Colne is not navigable in the affected reach.
Recreation	Minor	Negligible	Minor	Negligible	Minor	Negligible	During summer the potential for increased algal blooms could impacts the aesthetic quality of the river, making recreational activities less enjoyable.
Macroinvertebrates	Negligible	Negligible	Minor	Minor	Negligible	Negligible	Flows, levels and water quality unlikely to be significantly, permanently impacted as a result of the drought permit. Thus, impacts on the macroinvertebrate community is considered minor.
Fish	Negligible	Negligible	Moderate	Moderate	Negligible	Negligible	Availability of sub-optimal habitats may change as a result of increased flows.
Macrophytes	Negligible	Negligible	Minor	Minor	Negligible	Negligible	Flows, levels and water quality unlikely to be significantly, permanently impacted as a result of the drought permit. Thus, impacts on the macrophyte community is considered minor.
Diatoms	Negligible	Negligible	Minor	Minor	Negligible	Negligible	Flows, levels and water quality unlikely to be significantly, permanently impacted as a result of the drought permit. Thus, impacts on the diatom community is considered minor.

*Orthophosphate only **Groundwater only

Table 6.3: Monitoring and mitigation measures

Baseline (normal (non-drought) conditions)	• Baseline monitoring to establish baseline environmental conditions. • Identification of relevant stakeholders. • Encourage business as usual water saving behaviour.
Pre-drought (commence in potential drought)	• Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application. • Additional biological monitoring of macroinvertebrates, macrophytes, fish survey and water quality to supplement baseline monitoring, where required. • Contact all licensed abstractors within the potentially affected area and initiate engagement with key stakeholders . • Regular liaison with the Environment Agency. • Demand management / communications campaigns.
During drought (commence in drought period)	• Frequently monitor flow against temporary drought permit licence and cease abstraction at East Mills if flows drop too low. • Enhanced monitoring of water quality and biological communities to quantify the immediate impact of the drought.
Mitigation measures (commence on implementation of drought permit)	• Slow start and slow stop of augmentation discharge if possible. • Mitigation measures to rectify any potential impact upon other groundwater abstractors, if required. • Restriction of augmentation to the River Colne if groundwater quality is poor, as per the current licence conditions.
Post drought (commence after drought permit has been lifted)	• Continued flow monitoring in the River Colne to ensure that drought permit actions are no longer required. • Continued water quality and biological community monitoring to assess the need for continuation of mitigation measures.

6.4 Stakeholder consultation and implementation strategy

6.4.1 Stakeholder consultation

We obtained pre-consultation advice from the Environment Agency on our EAR methodology, as part of the development of the draft Drought Plan 2022. We also obtained statutory consultation advice from the Environment Agency, Natural England, and Historic England on the SEA Scoping report. Any concerns have been addressed through the EAR and SEA Environmental Report.

Other relevant stakeholders have been consulted during the Drought Plan 2022 consultation period, with any concerns being addressed for the final Drought Plan. Other stakeholders include:

- The Navigation Authority (Colchester Borough Council)
- Other abstractors
- Recreational user groups
- Other interested parties

No significant concerns are anticipated for this proposed drought permit, as it has been made available for consultation in previous Drought Plans.

For our full drought permit application we would include the following, as recommended by the guidance:

- Written consent from the Colchester Borough Council;
- Comments from those consulted about the application;
- Details of any objections received or agreements reached with objectors;
- A copy of the notices and advertisements relating to our application; and
- A description of our arrangements for the public inspection of the application.

6.4.2 Advertising the application

Our drought permit application would by published in the daily local newspaper circulating in the area affected by the permit (Colchester Gazette (circulation 8,230[22])). The newspaper also has a website. We would also advertise it in the London Gazette, as recommended by the guidance. We would consider publishing targeted social media updates in line with our communications strategy (**Appendix 10**).

6.4.3 Planning for all outcomes

We plan to engage with relevant stakeholders and address concerns in the creation of our Drought Plan and as part of the consultation process. In the event of a public hearing, we would confirm arrangements closer to the time. We have a number of regional Anglian Water offices which could be used as a venue or we would seek alternative venues or online alternatives as appropriate.

We would liaise closely with the Environment Agency before and during any permit application to ensure we have their support. We have agreed a robust mitigation programme with the Environment Agency and do not anticipate significant issues which may result in a public hearing.

In event of unsuccessful permit we would need to consider other supply-side options, such as rezoning or tankering, as well as increasing demand saving activities.

6.4.4 Drought permit review strategy

We would review our need for a drought permit once we enter potential drought status. This will include updating the data that would be needed to inform a permit. Any changes will be fed back into the EARs as required.

Appendices (on request)

- Draft permit
- Existing abstraction licence - plus a copy of any statutory instrument or local act connected to it or to a discharge permitted by the drought permit

Supporting Information

- **Appendix 7:** Environmental assessment summary
- **Appendix 8:** Environmental monitoring plan

[22] *https://www.abc.org.uk/product/2331-colchester-daily-gazette (June, 2018)*

7. Wellington Wellfield (Marham)

7.1 Current licence and proposed drought permit

7.1.1 Current licence

Wellington Wellfield

Anglian Water is licenced to abstract from chalk strata at five groundwater sources which comprise the Wellington Wellfield.

The following restrictions on maximum quantities of water abstracted apply at individual abstraction points:

Abstraction Point No.	Hourly quantity in m^3	Daily quantity in m^3	Yearly quantity in m^3	Instantaneous rate in litres per second
1	834	5,000	1,000,000	232
2	834	5,000	1,000,000	232
3	834	5,000	1,000,000	232
4	834	5,000	1,000,000	232
5	84	2,000	730,000	23.15

The aggregate quantity of water authorised to be abstracted under the licence must not exceed 15,000 m^3 per day and 1,500,000 m^3 per year.

The aggregate quantity of water authorised to be abstracted under the licence between April and October inclusive must not exceed 1,000,000 m^3.

The aggregate quantity of water authorised to be abstracted under the licence in any period of 90 days must not exceed 1,000,000 m^3.

The aggregate quantity of water authorised to be abstracted under this licence and the licence for Stoke Ferry must not exceed 6,570,000 m^3 per year.

The aggregate quantity of water authorised to be abstracted under this licence and the licence for Denton Lodge must not exceed 3,655,000 m^3 per year.

Denton Lodge

Anglian Water is licenced to abstract from chalk strata at two groundwater sources at Denton Lodge.

The following maximum quantities of water permitted to be abstracted apply:

- Abstraction Point 1: No more than 2,655,000 m^3 per year at rates not exceeding 7,274 m^3 per day and 303 m^3 per hour
- Abstraction Point 2: No more than 2,655,000 m^3 per year at rates not exceeding 7,274 m^3 per day and 303 m^3 per hour

The aggregate quantity of water authorised to be abstracted under the licence must not exceed 1,655,000 m^3 per year and 7,274 m^3 per day.

7.1.2 Proposed drought permit

The proposed drought permit would be to increase peak abstraction from the Wellington Wellfield OR Denton Lodge sources by 2.76 Ml/d in the form of:

- Wellington Wellfield licence increase from 15 Ml/d to 17.76 Ml/d, or
- Denton Lodge licence increase from 7.24 Ml/d to 10 Ml/d

The application would also propose an annual licence quality to 4575 Ml (an additional 2747.5 Ml) for the six months of the permit.

In line with current guidance, the drought permit would initially cover a six month period of either October to March (inclusive) for a winter permit or April to September (inclusive) for a summer permit. Subsequent reapplication for a further six months may be considered if required, depending on the drought situation at the time.

This would require a new application and additional environmental assessments. However, AWS consider it is extremely unlikely that it would need to apply for a second six month period, based on analysis carried out for our WRMP 2019, which shows the majority of our supply system is resilient to severe drought (approximately a 1 in 200 year event).

A copy of our current abstraction licence and a draft permit is available on request.

7.2 Justification of the need

7.2.1 Exceptional shortage of rain (ESOR)

For a Drought Order or permit to be granted, there is a legal requirement to demonstrate that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'.

Environment Agency guidance[23] states that it is not appropriate to set a prescriptive approach to assessing the ESOR as each drought and each situation is unique. The guidance provides a range of matters to consider when building the case for ESOR. This section provides an overview of our process for demonstrating an ESOR, following the guidance.

Rainfall is a key indicator in assessing drought conditions. Drought events vary in their duration, the time of year they commence and their magnitude (the extent of the rainfall deficit). Soil moisture conditions respond to precipitation anomalies on a relatively short timescale. Groundwater, streamflow and reservoir storage reflect the longer-term precipitation anomalies. These factors combine to produce a wide range of impacts on water resources.

As such, it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. The following data sources and methods would be used:

Standardised Precipitation Index (SPI)

We use the SPI to indicate the severity of low rainfall and if a drought may be developing. SPI values can be classified as shown in Table 7.1 following McKee et al. (1993)[24]. The World Meteorological Organisation's user guide[25] defines a drought event as occurring any time the SPI is continuously negative and reaches an intensity of -1.0 or lower. The drought event ends when the SPI becomes positive.

Table 7.1: SPI Values

SPI	Rainfall scenario
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

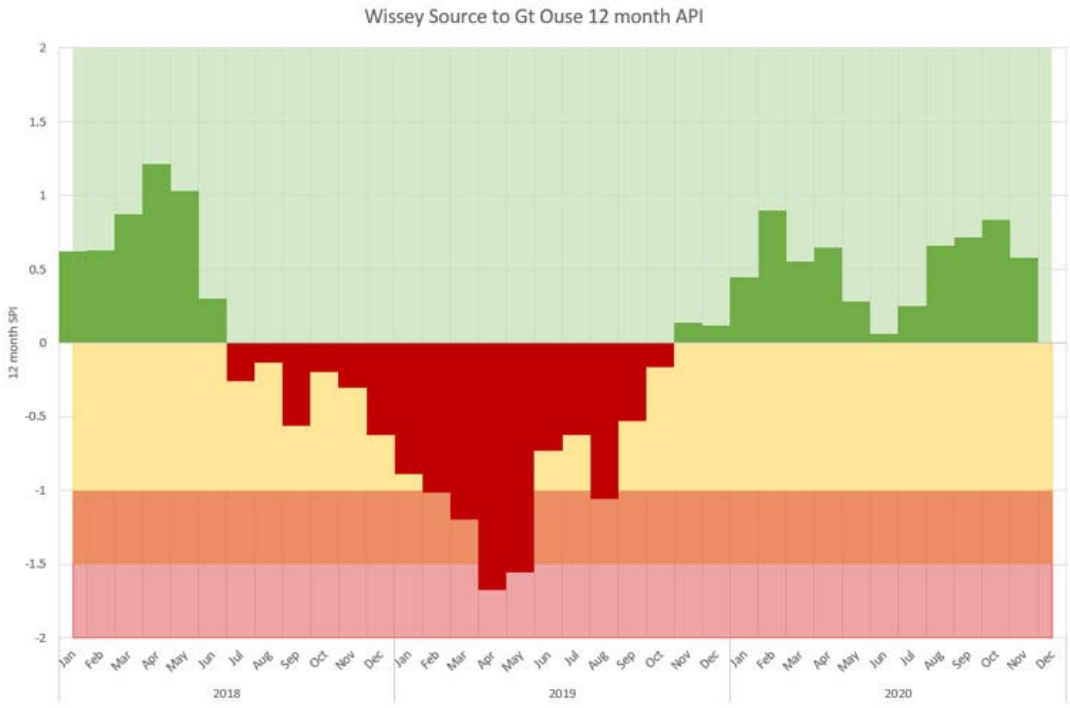
For the Wellington Wellfield, rainfall data for the Wissey Source to Great Ouse catchment is monitored at 1, 6, 12 and 24 month accumulations which allows the pattern and magnitude of longer term rainfall droughts to be measured. We use the 12 month accumulation SPI as an indicator in our drought response framework, and report on SPI as part of our BAU situation monitoring (Figure 7.1).

[23] *EA Drought Planning Guideline: Exceptional shortage of rain*

[24] *McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17-22 January 1993. Boston, American Meteorological Society, 179-184.*

[25] *World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.*

Figure 7.1: 12 month SPI chart for Wissey Source to Great Ouse



Atkins has carried out analysis of rainfall accumulation of historic and representative stochastically generated droughts at the sub-regional scale for the Anglian Water region[26]. We would compare the pattern and timings of contemporary rainfall accumulations with these historical and stochastic droughts in our assessment.

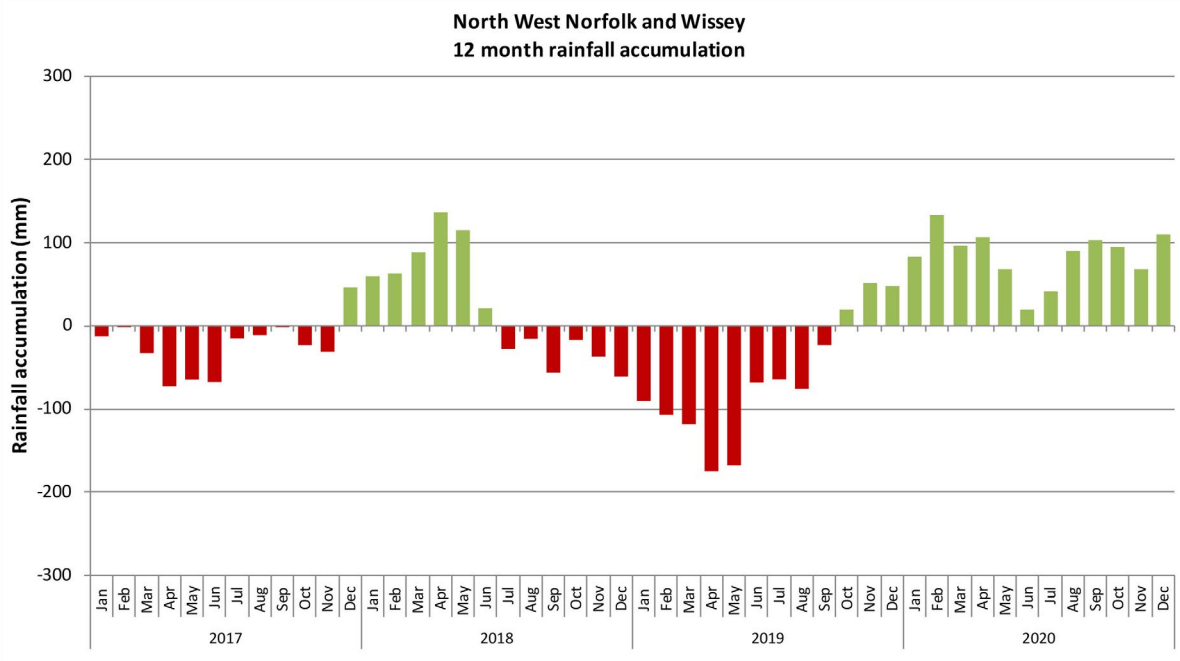
Rainfall ranking

We use the Environment Agency "rainfall by Hydrological Area" categorisations to monitor catchment variation in rainfall distribution. Rainfall data is collated by the Environment Agency from gauges within each hydrological catchment and aggregated for each area. The hydrological area is monitored at 1, 6, 12, 18, 24 and 36 month accumulations, which are then compared to the classifications derived from probability rankings and long term averages for each hydrological area. The probability bandings are derived based on Cunnane's calculations. These rolling rainfall accumulations allow the review of patterns and the magnitude of both annual and longer-term rainfall deficits (e.g. 1 or 2 dry winters) to be measured.

For the River Nar, rainfall data for the North West Norfolk and Wissey hydrological catchment is monitored at 1, 6, 12, 18, 24 and 36 month accumulations and classified as per the probability calculations discussed above. An example of the 12 month rainfall accumulations can be seen in Figure 7.2.

[26] *Drought Selection Process and Criteria - Anglian Water Services (Atkins, 2017)*

Figure 7.2: 12 month rolling rainfall accumulation (mm) departures from the Long Term Average for North West Norfolk and Wissey



Other indicators of ESOR

We would support a case for ESOR by presenting other measures, such as soil moisture deficit, effective rainfall, temperature, river flows and groundwater levels (details on these data sources can be found in **Section 2.2, Main Plan**). This would include comparison to the long-term average and trend analysis. We would also describe our current operational water supply situation, to include reservoir storage levels against drought management curves, and forecast projections for a range of rainfall scenarios. Relevant impacts and mitigation actions carried out in the wider supply system would also be detailed.

7.3 Environmental assessment

An environmental assessment of the impact of the drought permit was carried out for the Drought Plan 2022 by Ricardo Energy and Environment, building on the work completed for the Drought Plan 2019 by Mott MacDonald / Atkins. This assesses the potential environmental impacts of implementing the proposed drought action, following Defra and Environment Agency guidance. The findings are detailed in a separate EAR, and summarised in **Appendix 7 and 8**, with a brief overview here.

The environmental assessment demonstrates that the proposed drought permit would have negligible environmental risk on surface water receptors but a minor-moderate risk to groundwater receptors. Any adverse effects on environmental variables would be non-permanent and the predicted changes are not anticipated to result in any deterioration in WFD status. However, there is a possibility that other groundwater abstractors may be impacted through additional drawdown as a result of the permit.

The HRA Stage II Appropriate Assessment concluded that with the implementation of proposed mitigation measures no adverse effects on groundwater dependent qualifying features of the Breckland SAC are anticipated.

The key findings of the environmental assessment are summarised in Table 7.2.

Table 7.3 shows baseline, pre-drought, during drought, mitigation measures and post drought surveys for the proposed drought action for the Wellington Wellfield Zone of Influence (ZoI).

Table 7.2: Summary of environmental impacts of proposed drought permit in the Wellington Wellfield ZoI

River Reach	Groundwater ZoI		River Wissey			River Little Ouse		Cut Off Channel	Commentary
Impact	**Predicted Impact Summer**	**Predicted Impact Winter**	**Reach 1 Predicted Impact**	**Reach 2 Predicted Impact**	**Reach 3 Predicted Impact**	**Reach 1 Predicted Impact**	**Reach 2 Predicted Impact**	**Reach 1 Predicted Impact**	
Hydrology (Level and flow)	N/A	N/A	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible impacts on river level and flow
Geomorphology	N/A	N/A	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible as a result of negligible impacts on river level and flow
Water Quality	Not Assessed	Not Assessed	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible as a result of negligible impacts on river level and flow
Other abstractors	Minor - Moderate	Minor - Moderate	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Groundwater drawdown may impact other licensed groundwater abstractors
Navigation	N/A	N/A	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	No mechanisms for potential impact
Recreation	N/A	N/A	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	No mechanisms for potential impact
Designated Sites	Moderate (Didlington Park Lakes SSSI)	Minor - Moderate	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Not Assessed	Most summer impacts are negligible except at Didlington Park Lakes SSSI. Winter sees additional impacts at Breckland SAC, Foulden Common SSSI, Norfolk Valley SAC. All other designated sites in the ZoI are assessed as negligible impact.

Table 7.3: Monitoring and mitigation measures

Baseline (normal (non-drought) conditions)	• Baseline monitoring to establish baseline environmental conditions. • Identification of relevant stakeholders. • Encourage business as usual water saving behaviour.
Pre-drought (commence in potential drought)	• Continuation of baseline monitoring. • Infill monitoring by AWS if required. • Establish most appropriate stakeholder engagement methods. • Demand management campaigns.
During drought (commence in drought period)	• NVC surveys within wetland habitat units of statutory designated sites. • Continuation of baseline monitoring for hydrology sites. Regularly track results and if baseline monitoring identifies any impacts, additional ecological monitoring and mitigation should be reviewed.
Mitigation measures (commence on implementation of drought permit)	• Halt abstraction if groundwater levels deteriorate below acceptable levels. • Variable abstraction to allow occasional pulses of water throughout the system to aid in the flushing of pollutants and prevent stagnation. • Mitigation measures to rectify any potential impact upon other groundwater abstractors, if required. • Halt abstraction if baseline monitoring shows detrimental impact within Little Ouse or River Wissey.
Post drought (commence after drought permit has been lifted)	• Continuation of baseline monitoring. • Continued increased frequency of ecological monitoring at designated sites for three years after the cessation of the drought permit. • Post-permit review of stakeholder engagement.

7.4 Stakeholder consultation and implementation strategy

7.4.1 Stakeholder consultation

We obtained pre-consultation advice from the Environment Agency on our EAR methodology, as part of the development of the draft Drought Plan 2022. We also obtained statutory consultation advice from the Environment Agency, Natural England, and Historic England on the SEA Scoping report. Any concerns have been addressed through the EAR and SEA Environmental Report.

Other relevant stakeholders have been consulted during the Drought Plan 2022 consultation period, with any concerns being addressed for the final Drought Plan. Other stakeholders include:

- The Navigation Authority (Environment Agency)
- Other abstractors
- Recreational user groups
- Other interested parties

No significant concerns are anticipated for this proposed drought permit, as it has been made available for consultation in previous Drought Plans.

For our full drought permit application we would include the following, as recommended by the guidance:

- Written consent from the Environment Agency;
- Comments from those consulted about the application;
- Details of any objections received or agreements reached with objectors;
- A copy of the notices and advertisements relating to our application; and
- A description of our arrangements for the public inspection of the application.

7.4.2 Advertising the application

Our drought permit application would by published in the daily local newspaper circulating in the area affected by the permit (Eastern Daily Press (circulation 26,788[27])). The newspaper also has a website. We would also advertise it in the London Gazette, as recommended by the guidance. We would consider publishing targeted social media updates in line with our communications strategy (**Appendix 10**).

7.4.3 Planning for all outcomes

We plan to engage with relevant stakeholders and address concerns in the creation of our Drought Plan and as part of the consultation process. In the event of a public hearing, we would confirm arrangements closer to the time. We have a number of regional Anglian Water offices which could be used as a venue or we would seek alternative venues or online alternatives as appropriate.

We would liaise closely with the Environment Agency before and during any permit application to ensure we have their support. We have agreed a robust mitigation programme with the Environment Agency and do not anticipate significant issues which may result in a public hearing.

In event of unsuccessful permit we would need to consider other supply-side options, as set out in **Appendix 3**.

7.4.4 Drought permit review strategy

We would review our need for a drought permit once we enter potential drought status. This will include updating the data that would be needed to inform a permit. Any changes will be fed back into the EARs as required.

Appendices (on request)

- Draft permit
- Existing abstraction licence - plus a copy of any statutory instrument or local act connected to it or to a discharge permitted by the drought permit

Supporting Information

- **Appendix 7:** Environmental assessment summary
- **Appendix 8:** Environmental monitoring plan

[27] *https://www.abc.org.uk/product/2302-norwich-eastern-daily-press (June 2018)*

8. River Wensum (Costessey groundwater sources)

8.1 Current licence and proposed drought permit

8.1.1 Current licence

Anglian Water is licenced to abstract from the Costessey groundwater source.

The current abstraction licences for Costessey and Heigham intakes are given in Table 8.1.

Table 8.1. Costessey groundwater sources and Heigham abstraction and transfer licences

Licence description	Daily quantity (Ml/d)	Annual quantity (Ml/yr)	Combined Annual (Ml/yr)			Comments
Costessey Pits PWS	57.7	17,000		NORPWS: 57.7 Ml/d; 17000 Ml/yr	HEICOS: 57.7 Ml/d; 17000 Ml/yr	Level restriction <5.6 mAOD
Heigham intake PWS	57.7		COSHIM: 120 Ml/d 17000 Ml/yr			Residual flow of 27 Ml/d required downstream of abstraction
Heigham intake transfer to Pits	57.7					Residual flow of 49 Ml/d require downstream of abstraction
Costessey intake transfer to Pits	120					Subject to stepped residual flow at Costessey Mill gauging station and 5.3 mAOD level covenant at Costessey Mill.
Costessey groundwater sources	30	2000		NORPWS (see above)		Daily reduces to 20 Ml/d and annual to 1000 Ml/yr on 31/03/24

COSHIM, NORPWS and HEICOS are names of AWS group licences

8.1.2 Proposed drought permit

The following permit application would be made for the River Wensum intake:

- Increase the annual abstraction quantity for the Costessey groundwater source from 2,000 Ml/yr to 4,800 Ml/yr at a maximum instantaneous abstraction rate of 30 Ml/d (347 l/s).

It is possible that during a severe drought, flows in the River Wensum may be reduced, such that use of the intake is compromised. In the event of a severe drought, it is proposed that the groundwater source could be used to support supply. To achieve this, the drought permit would support a temporary increase in the maximum annual licensed abstraction rate at the groundwater abstraction if required.

In line with current guidance, the drought permit would initially cover a six month period of either October to March (inclusive) for a winter permit or April to September (inclusive) for a summer permit. Subsequent reapplication for a further six months may be considered if required, depending on the drought situation at the time.

This would require a new application and additional environmental assessments. However, AWS consider it is extremely unlikely that it would need to apply for a second six month period, based on analysis carried out for our WRMP 2019, which shows the majority of our supply system is resilient to severe drought (approximately a 1 in 200 year event).

We have developed triggers to guide us through the different stages of the drought permit application process, and these are detailed in **Appendix 5**.

A copy of our current abstraction licence and a draft permit is available on request.

8.2 Justification of the need

8.2.1 Exceptional shortage of rain (ESOR)

For a Drought Order or permit to be granted, there is a legal requirement to demonstrate that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'.

Environment Agency guidance[28] states that it is not appropriate to set a prescriptive approach to assessing the ESOR as each drought and each situation is unique. The guidance provides a range of matters to consider when building the case for ESOR. This section provides an overview of our process for demonstrating an ESOR, following the guidance.

Rainfall is a key indicator in assessing drought conditions. Drought events vary in their duration, the time of year they commence and their magnitude (the extent of the rainfall deficit). Soil moisture conditions respond to precipitation anomalies on a relatively short timescale. Groundwater, streamflow and reservoir storage reflect the longer-term precipitation anomalies. These factors combine to produce a wide range of impacts on water resources.

As such, it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. The following data sources and methods would be used:

Standardised Precipitation Index (SPI)

We use the SPI to indicate the severity of low rainfall and if a drought may be developing. SPI values can be classified as shown in Table 8.2 following McKee et al. (1993)[29]. The World Meteorological Organisation's user guide[30] defines a drought event as occurring any time the SPI is continuously negative and reaches an intensity of-1.0 or lower. The drought event ends when the SPI becomes positive.

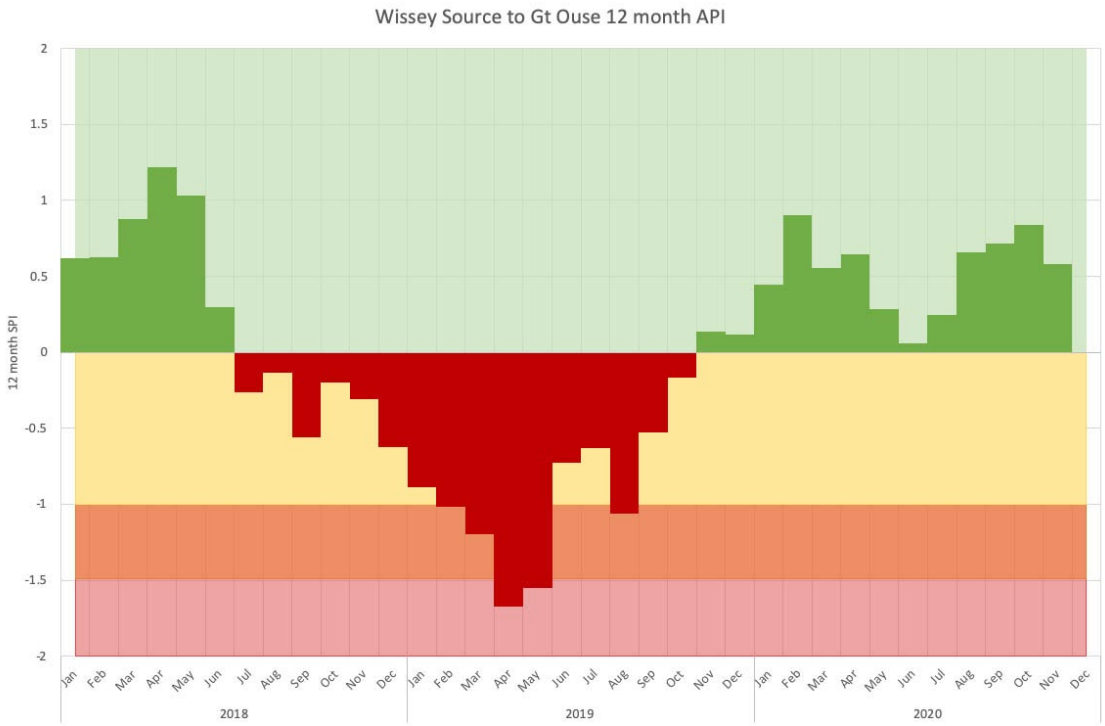
Table 8.2: SPI Values

SPI	Rainfall scenario
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

For the River Wensum, rainfall data for the Wensum at Costessey catchment is monitored at 1, 6, 12 and 24 month accumulations which allows the pattern and magnitude of longer term rainfall droughts to be measured. We use the 12 month accumulation SPI as an indicator in our drought response framework, and report on SPI as part of our BAU situation monitoring (Figure 8.1).

[28] *EA Drought Planning Guideline: Exceptional shortage of rain*
[29] *McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17-22 January 1993. Boston, American Meteorological Society, 179-184.*
[30] *World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva*

Figure 8.1: 12 month SPI chart for Wensum at Costessey



Atkins has carried out analysis of rainfall accumulation of historic and representative stochastically generated droughts at the sub-regional scale for the Anglian Water region[31]. We would compare the pattern and timings of contemporary rainfall accumulations with these historical and stochastic droughts in our assessment.

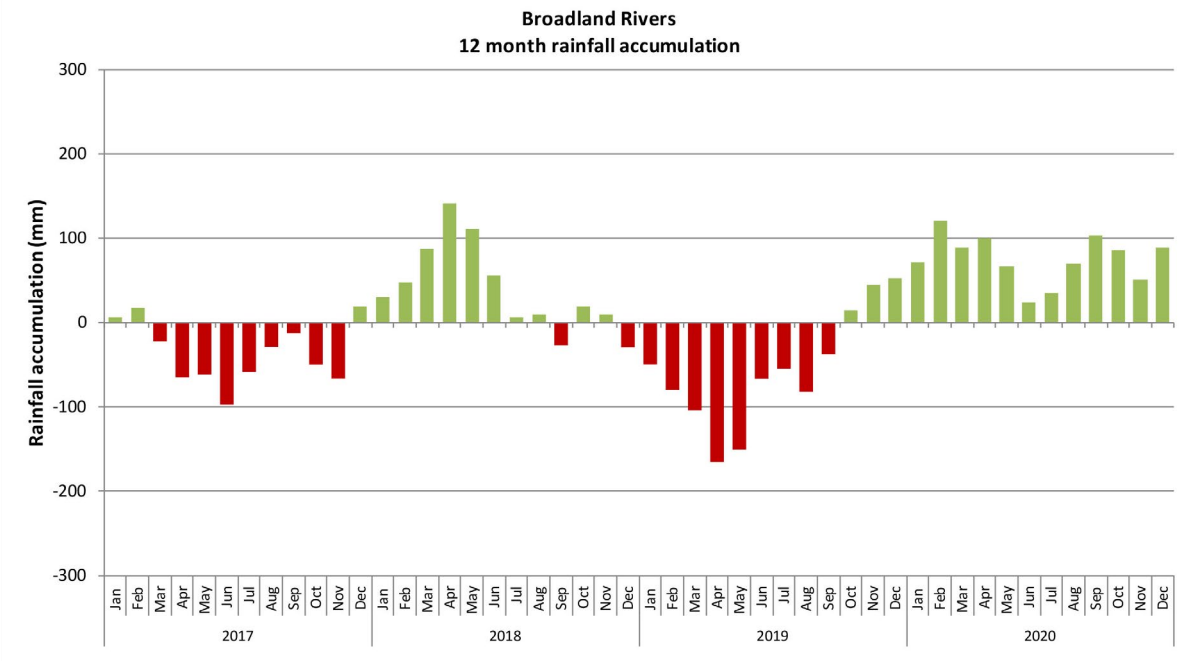
Rainfall ranking

We use the Environment Agency "rainfall by Hydrological Area" categorisations to monitor catchment variation in rainfall distribution. Rainfall data is collated by the Environment Agency from gauges within each hydrological catchment and aggregated for each area. The hydrological area is monitored at 1, 6, 12, 18, 24 and 36 month accumulations, which are then compared to the classifications derived from probability rankings and long term averages for each hydrological area. The probability bandings are derived based on Cunnane's calculations. These rolling rainfall accumulations allow the review of patterns and the magnitude of both annual and longer-term rainfall deficits (e.g. 1 or 2 dry winters) to be measured.

For the River Wensum, rainfall data for the Broadland Rivers hydrological catchment is monitored at 1, 6, 12, 18, 24 and 36 month accumulations and classified as per the probability calculations discussed above. An example of the 12 month rainfall accumulations can be seen in Figure 8.2.

[31] *Drought Selection Process and Criteria - Anglian Water Services (Atkins, 2017)*

Figure 8.2: 12 month rolling rainfall accumulation (mm) departures from the Long Term Average for the Broadland Rivers



Other indicators of ESOR

We would support a case for ESOR by presenting other measures, such as soil moisture deficit, effective rainfall, temperature, river flows and groundwater levels (details on these data sources can be found in **Section 2.2, Main Plan**). This would include comparison to the long-term average and trend analysis. We would also describe our current operational water supply situation, to include reservoir storage levels against drought management curves, and forecast projections for a range of rainfall scenarios. Relevant impacts and mitigation actions carried out in the wider supply system would also be detailed.

8.3 Environmental assessment

An environmental assessment of the impact of the drought permit was carried out for the Drought Plan 2022 by Ricardo Energy and Environment, building on the work completed for the Drought Plan 2019 by Mott MacDonald / Atkins. This assesses the potential environmental impacts of implementing the proposed drought action, following Defra and Environment Agency guidance. The findings are detailed in a separate EAR, and summarised in **Appendix 7 and 8**, with a brief overview here.

Impacts on river water levels and flows were perceived to be minimal with some minor impacts to localised river flows in the River Wensum SAC, downstream of the Costessey intake. Groundwater levels are expected to reduce as far as the SSSI land parcels that have been identified as optimum habitat for Desmoulins's whorl snail (Land Parcels 38-44). Modelled drawdown is up to 2.5 m at Land Parcels 38-39, and the land parcels are also thought to be in hydrological connectivity with the river. Monitoring is needed to better understand the contributions of groundwater and surface water to the land parcels and the suitability for snail habitat.

The report concluded that there is potential for up to moderate adverse effects on ecology including designated features as a result of the predicted reduction in flows on the River Wensum and adjacent groundwater levels, and that a HRA Stage II Appropriate Assessment was required to fully assess the predicted impacts on the qualifying features of the River Wensum SAC. This concluded that even with the inclusion of mitigation measures, uncertainty remained regarding the potential adverse effects on site integrity of the River Wensum (Costessey groundwater sources) on the River Wensum SAC and associated qualifying features. Further assessment would be required in advance of the drought permit application based on contemporary conditions.

The key findings of the environmental assessment are summarised in Table 8.3.

Table 8.4 shows baseline, pre-drought, during drought, mitigation measures and post drought surveys for the proposed drought action at Costessey.

Table 8.3: Summary of environmental impacts of proposed drought permit in the River Wensum, Tud and Yare

River Reach	River Wensum						River Tud		River Yare		Commentary
Impact	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 2 Predicted Impact Summer	Reach 2 Predicted Impact Winter	Reach 3 Predicted Impact Summer	Reach 3 Predicted Impact Winter	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	
Hydrology (Level and flow)	Negligible	Negligible	Minor	Negligible	Minor	Minor	Negligible	Negligible	Negligible	Negligible	Adverse effects on river level and flow are minor and temporary
Geomorphology	Negligible	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Adverse effects on geomorphology are minor and temporary, localised to downstream of the Costessey intake
Water Quality	Negligible	Negligible	Minor	Negligible	Not assessed (no data)	Not assessed (no data)	Negligible	Negligible	Negligible	Negligible	Adverse effects on water quality are minor and temporary, localised to downstream of the Costessey intake
Other abstractors	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Negligible	Negligible	Negligible	Negligible	Groundwater drawdown may impact other licensed groundwater abstractors
Navigation	Not assessed	Not assessed	Negligible	Negligible	Negligible	Negligible	Not assessed	Not assessed	Not assessed	Not assessed	No mechanisms for potential impact
Recreation	Not assessed	Not assessed	Moderate	Moderate	Moderate	Moderate	Not assessed	Not assessed	Not assessed	Not assessed	Drawdown at Costessey Pits 1, 2 and 3 and Taverham Lake may impact fish stocks and water sports
Macroinvertebrates	Not assessed	Not assessed	Minor	Minor	Minor	Minor	Not assessed	Not assessed	Not assessed	Not assessed	Potential impact on ecological structure minimal given impacts on hydrology and water quality and baseline community characteristics present. Desmoulin's whorl snail has been assessed separately with moderate impacts given possible wetland habitat loss within the SAC / SSSI sites.

River Reach / Impact	River Wensum						River Tud		River Yare		Commentary
	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 2 Predicted Impact Summer	Reach 2 Predicted Impact Winter	Reach 3 Predicted Impact Summer	Reach 3 Predicted Impact Winter	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	
Fish	Not assessed	Not assessed	Moderate	Moderate	Moderate	Moderate	Not assessed	Not assessed	Not assessed	Not assessed	Potential impact on ecological structure including fish migration, passage and spawning behaviours as a result of reduced river flow.
Macrophytes	Not assessed	Not assessed	Minor	Minor	Minor	Minor	Not assessed	Not assessed	Not assessed	Not assessed	Potential impact on ecological structure minimal given impacts on hydrology and water quality and baseline community characteristics present.
Diatoms	Not assessed	Not assessed	Minor	Minor	Minor	Minor	Not assessed	Not assessed	Not assessed	Not assessed	Potential impact on ecological structure minimal given impacts on hydrology and water quality. No baseline community data available.

Table 8.4: Monitoring and mitigation measures

Baseline (normal (non-drought) conditions)	• Baseline monitoring to establish baseline environmental conditions. • Identification of relevant stakeholders. • Encourage business as usual water saving behaviour. • Investigation into current use of licenced and private abstractions. • Produce a Water Level Management Plan for River Wensum SSSI units 40-44**.**
Pre-drought (commence in potential drought)	• Frequent monitoring of flow / level data during periods of low flow to identify the trigger for initiating a drought permit application, at key sites along the River Wensum, at Costessey Pits and Taversham Lake. • Desmoulin's whorl snail surveys at Hellesdon Meadows (SSSI Units 40-44) and SSSI Units 38-39. • Additional biological monitoring of macroinvertebrates, macrophytes, fish survey and water quality to supplement baseline monitoring, where required. • Contact all licensed abstractors within the potentially affected area, and initiate engagement with key stakeholders including navigational and recreational users. • Regular liaison with the Environment Agency. • Demand management/publicity campaigns.
During drought (commence in drought period)	• As above, plus enhanced monitoring of water quality and biological communities to quantify the immediate impact of the drought in River Wensum and Costessey Pits. • Monitoring of groundwater levels at observation boreholes outside 5 km radius of influence.
Mitigation measures (commence on implementation of drought permit)	• Implementation of the Water Level Management plan on SSSI units 38-39 and 40-44, including spray / drip irrigation for Desmoulin's whorl snail if required. • Fish relocation from Costessey Pits or Taverham Lake if water levels drop or water quality deteriorates significantly. • Mitigation measures to rectify any potential impact upon other groundwater abstractors, if required.
Post drought (commence after drought permit has been lifted)	• Post drought (commence after drought permit has been lifted). • Continued ground and surface water monitoring at River Wensum SSSI units 38 to 44, Costessey Pits and Taverham Lake to assess when mitigation measures are no longer required. • Continued increased frequency of ecological monitoring for three years after the cessation of the drought permit.

8.4 Stakeholder consultation and implementation strategy

8.4.1 Stakeholder consultation

We obtained pre-consultation advice from the Environment Agency on our EAR methodology, as part of the development of the draft Drought Plan 2022. We also obtained statutory consultation advice from the Environment Agency, Natural England, and Historic England on the SEA Scoping report. Any concerns have been addressed through the EAR and SEA Environmental Report.

Other relevant stakeholders have been consulted during the Drought Plan 2022 consultation period, with any concerns being addressed for the final Drought Plan. Other stakeholders include:

- The Navigation Authority (Broads Authority)
- Other abstractors
- Recreational user groups
- Other interested parties

No significant concerns are anticipated for this proposed drought permit, as it has been made available for consultation in previous Drought Plans.

For our full drought permit application we would include the following, as recommended by the guidance:

- Written consent from the Broads Authority
- Comments from those consulted about the application
- Details of any objections received or agreements reached with objectors
- A copy of the notices and advertisements relating to our application; and
- A description of our arrangements for the public inspection of the application

8.4.2 Advertising the application

Our drought permit application would by published in the daily local newspaper circulating in the area affected by the permit (Norwich Evening News (circulation 7,507[32]) and the Eastern Daily Press). The newspaper also has a website. We would also advertise it in the London Gazette, as recommended by the guidance. We would consider publishing targeted social media updates in line with our communications strategy (**Appendix 10**).

8.4.3 Planning for all outcomes

We plan to engage with relevant stakeholders and address concerns in the creation of our Drought Plan and as part of the consultation process. In the event of a public hearing, we would confirm arrangements closer to the time. We have a number of regional Anglian Water offices which could be used as a venue or we would seek alternative venues or online alternatives as appropriate.

We would liaise closely with the Environment Agency before and during any permit application to ensure we have their support. We have agreed a robust mitigation programme with the Environment Agency and do not anticipate significant issues which may result in a public hearing.

In event of unsuccessful permit we would need to consider other supply side options, such as rezoning or tankering, as well as increasing demand saving activities.

8.4.4 Drought permit review strategy

We would review our need for a drought permit once we enter potential drought status. This will include updating the data that would be needed to inform a permit. Any changes will be fed back into the EARs as required.

Appendices

- Draft permit
- Existing abstraction licence - plus a copy of any statutory instrument or local act connected to it or to a discharge permitted by the drought permit

Supporting Information

- **Appendix 7:** Environmental assessment summary
- **Appendix 8:** Environmental monitoring plan

[32] *Press Gazette, 2018 (https://pressgazette.co.uk/regional-abcs-print-steep-circulation-falls-for-dailies-the-yorkshire-evening-post-and-carlisle-news-star/2/)*

9. River Trent

9.1 Current licence and proposed drought permit

9.1.1 Current licence

Anglian Water is licenced to abstract from the River Trent at Hall WTW.

The licence is subject to a Hands Off Flow (HOF) condition, which restricts abstraction when the flow of the River Trent is equal to or less than 1,700 Ml/d, as gauged by the Environment Agency at its flow gauging station at North Muskham.

The abstraction is also subject to a Hands Off Level (HOL).

9.1.2 Proposed drought permit

The following permit application would be made for the River Trent intake:

- Reduction of the HOF from 1700 Ml/d to 1450 Ml/d

The proposed drought permit application would be triggered when flows at North Muskham fall below 2100 Ml/d, although considerations of the rate of decline in river flow and rainfall will also be relevant. The drought permit will not seek to change the HOL.

In line with current guidance, the drought permit would initially cover a six month period of either October to March (inclusive) for a winter permit or April to September (inclusive) for a summer permit. Subsequent reapplication for a further six months may be considered if required, depending on the drought situation at the time.

This would require a new application and additional environmental assessments. However, AWS consider it is extremely unlikely that it would need to apply for a second six month period, based on analysis carried out for our WRMP 2019, which shows the majority of our supply system is resilient to severe drought (approximately a 1 in 200 year event).

The permit would be required if the flows in the Trent reduced to a level that compromised the maintenance of supply. We have developed triggers to guide us through the different stages of the drought permit application process, and these are detailed in **Appendix 5**.

A copy of our current abstraction licence and a draft permit is available on request.

9.2 Justification of the need

9.2.1 Exceptional shortage of rain (ESOR)

For a Drought Order or permit to be granted, there is a legal requirement to demonstrate that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'.

Environment Agency guidance[33] states that it is not appropriate to set a prescriptive approach to assessing the ESOR as each drought and each situation is unique. The guidance provides a range of matters to consider when building the case for ESOR. This section provides an overview of our process for demonstrating an ESOR, following the guidance.

Rainfall is a key indicator in assessing drought conditions. Drought events vary in their duration, the time of year they commence and their magnitude (the extent of the rainfall deficit). Soil moisture conditions respond to precipitation anomalies on a relatively short timescale. Groundwater, streamflow and reservoir storage reflect the longer-term precipitation anomalies. These factors combine to produce a wide range of impacts on water resources.

As such, it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. The following data sources and methods would be used:

Standardised Precipitation Index (SPI)

We use the SPI to indicate the severity of low rainfall and if a drought may be developing. SPI values can be classified as shown in Table 9.1 following McKee et al. (1993)[34]. The World Meteorological Organisation's user guide[35] defines a drought event as occurring any time the SPI is continuously negative and reaches an intensity of-1.0 or lower. The drought event ends when the SPI becomes positive.

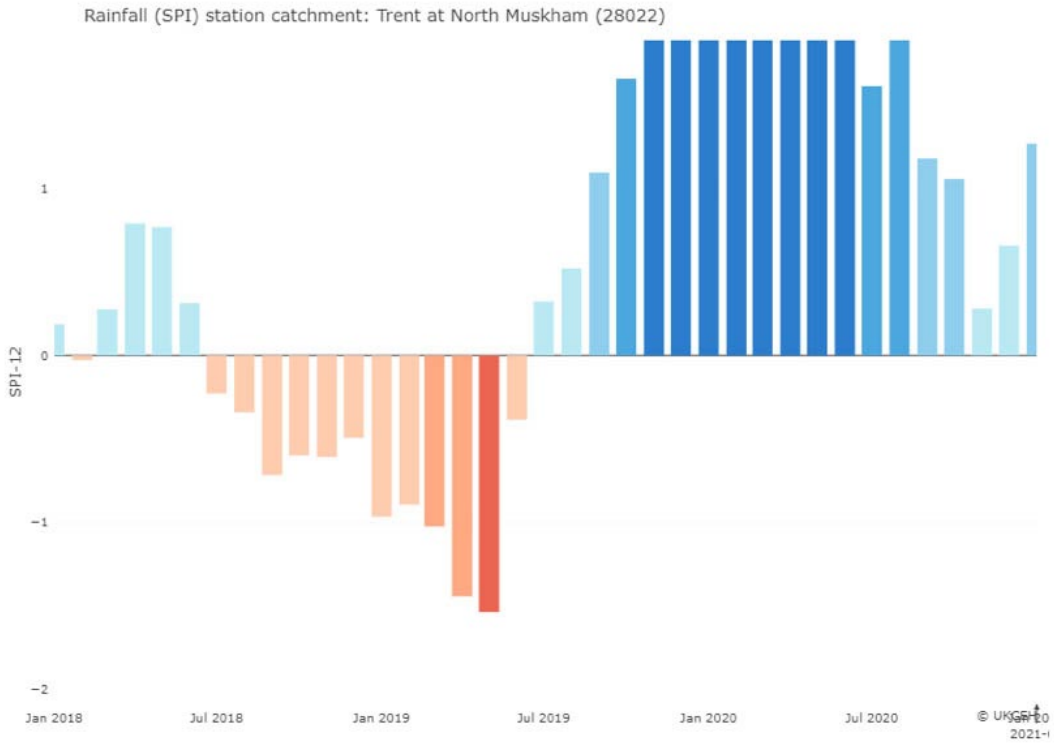
Table 9.1: SPI Values

SPI	Rainfall scenario
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-0.99 to 0.99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

For the River Trent, rainfall data for the Trent at North Muskham catchment is monitored at 1, 6, 12 and 24 month accumulations which allows the pattern and magnitude of longer term rainfall droughts to be measured. We use the 12 month accumulation SPI as an indicator in our drought response framework, and report on SPI as part of our BAU situation monitoring (Figure 9.1).

[33] *EA Drought Planning Guideline: Exceptional shortage of rain*
[34] *McKee, T.B., N.J. Doesken and J. Kleist, 1993: The relationship of drought frequency and duration to time scale. In: Proceedings of the Eighth Conference on Applied Climatology, Anaheim, California, 17-22 January 1993. Boston, American Meteorological Society, 179-184.*
[35] *World Meteorological Organization, 2012: Standardized Precipitation Index User Guide (M. Svoboda, M. Hayes and D. Wood). (WMO-No. 1090), Geneva.*

Figure 9.1: 12 month SPI chart for Trent at North Muskham (taken direct from Water Resources portal[36])



Atkins has carried out analysis of rainfall accumulation of historic and representative stochastically generated droughts at the sub-regional scale for the Anglian Water region[37]. We would compare the pattern and timings of contemporary rainfall accumulations with these historical and stochastic droughts in our assessment.

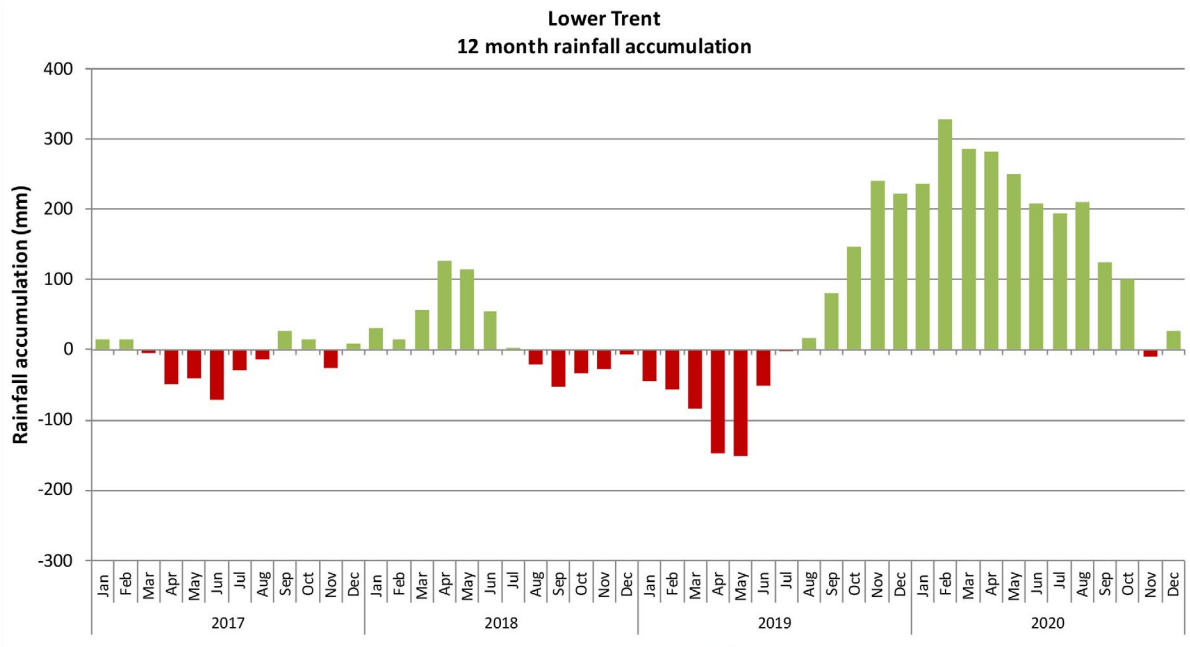
Rainfall ranking

We use the Environment Agency "rainfall by Hydrological Area" categorisations to monitor catchment variation in rainfall distribution. Rainfall data is collated by the Environment Agency from gauges within each hydrological catchment and aggregated for each area. The hydrological area is monitored at 1, 6, 12, 18, 24 and 36 month accumulations, which are then compared to the classifications derived from probability rankings and long term averages for each hydrological area. The probability bandings are derived based on Cunnane's calculations. These rolling rainfall accumulations allow the review of patterns and the magnitude of both annual and longer-term rainfall deficits (e.g. 1 or 2 dry winters) to be measured.

For the River Trent, rainfall data for the Lower Trent hydrological catchment is monitored at 1, 6, 12, 18, 24 and 36 month accumulations and classified as per the probability calculations discussed above. An example of the 12 month rainfall accumulations can be seen in Figure 9.2.

[36] *https://eip.ceh.ac.uk/hydrology/water-resources/*
[37] *Drought Selection Process and Criteria - Anglian Water Services (Atkins, 2017)*

Figure 9.2: 12 month rolling rainfall accumulation (mm) departures from the Long Term Average for the Lower Trent



Other indicators of ESOR

We would support a case for ESOR by presenting other measures, such as soil moisture deficit, effective rainfall, temperature, river flows and groundwater levels (details on these data sources can be found in **Section 2.2, Main Plan**). This would include comparison to the long-term average and trend analysis. We would also describe our current operational water supply situation, to include reservoir storage levels against drought management curves, and forecast projections for a range of rainfall scenarios. Relevant impacts and mitigation actions carried out in the wider supply system would also be detailed.

9.3 Environmental assessment

An environmental assessment of the impact of the drought permit was carried out for the Drought Plan 2022 by Ricardo Energy and Environment. This assesses the potential environmental impacts of implementing the proposed drought action, following Defra and Environment Agency guidance. The findings are summarised in **Appendix 7 and 8**, with a brief overview here.

Impact on river flow and water level is considered to be negligible. As a result, impacts on water quality ecology are not expected. However, baseline monitoring has been proposed to provide an opportunity for tracking any change, to ensure that the drought permit does not have any significant impacts upon the environment or other activities.

The HRA Stage I: Screening Assessment concluded that there are no likely significant effects of the proposed drought permit upon European designated sites.

The key findings of the environmental assessment are summarised in Table 9.2.

Table 9.2: Summary of environmental impacts of proposed drought permit in the River Trent

Impact	Reach 1 Predicted Impact Summer	Reach 1 Predicted Impact Winter	Commentary
Hydrology (Level and flow)	Negligible	Negligible	Water levels are predicted to reduce by less than 1 cm downstream of the abstraction point - negative impacts on flow and level are not expected.
Geomorphology	Negligible	Negligible	Negative impacts on sediment loading, transport erosion and deposition are not expected.
Water Quality	Negligible	Negligible	The proposed drought permit is not expected to affect water quality or the overall status of the WFD waterbodies within and downstream of the River Trent.
Other abstractors	Negligible	Negligible	Because of the small scale of the reduction it is considered highly unlikely that there would be any adverse impact to other abstractors.
Navigation	Not assessed	Not assessed	Negative impacts on navigation and other recreational uses of the River Trent are not expected.
Recreation	Not assessed	Not assessed	Negative impacts on navigation and other recreational uses of the River Trent are not expected.
Macroinvertebrates	Not assessed	Not assessed	No significant adverse effects on the communities of macroinvertebrates present in the River Trent are predicted.
Fish	Not assessed	Not assessed	No significant adverse effects on the communities of fish present in the River Trent are predicted.
Macrophytes	Not assessed	Not assessed	No significant adverse effects on the communities of macrophytes present in the River Trent are predicted.
Diatoms	Not assessed	Not assessed	No significant adverse effects on the communities of diatoms present in the River Trent are predicted.

The environmental assessment for the River Trent intake has indicated that in the absence of any significant environmental impacts, only baseline monitoring is recommended to be carried out. However if baseline monitoring shows detrimental impacts to water quality, hydrology or ecological receptors within the Trent, ecological monitoring and mitigation will need to be reviewed as below. The suggested monitoring and mitigation measures have been summarised in Table 9.3 below.

AWS would be responsible for implementing any measures, but the need for these measures will be agreed at the time in collaboration with the Environment Agency, and any other relevant stakeholders.

Table 9.3: Monitoring and mitigation measures

Baseline (normal (non-drought) conditions)	• Baseline monitoring to establish baseline environmental conditions. • Identification of relevant stakeholders. • Encourage business as usual water saving behaviour.
Pre-drought (commence in potential drought)	• Continuation of baseline monitoring. • Undertake lamprey surveys.
During drought (commence in drought period)	• Continuation of baseline monitoring with lamprey surveys. Regularly track results to confirm no detrimental impacts to water quality, hydrology or ecological receptors. • If baseline monitoring identifies any impacts, additional ecological monitoring and mitigation should be reviewed.

Mitigation measures (commence on implementation of drought permit)	• Drought permit abstraction will cease if:
	  • The flow drops below the temporarily reduced HOF, based on flow monitoring results at North Muskham, or
	  • Significant impacts on other receptors, such as water quality, hydrology, or ecology, are identified.

Post drought (commence after drought permit has been lifted)	• Continuation of baseline monitoring. • Undertake post drought lamprey surveys. • If any additional ecological monitoring has been undertaken, this monitoring should continue for up to three years after the drought.

9.4 Stakeholder consultation and implementation strategy

9.4.1 Stakeholder consultation

We obtained pre-consultation advice from the Environment Agency on our EAR methodology, as part of the development of the draft Drought Plan 2022. We also obtained statutory consultation advice from the Environment Agency, Natural England, and Historic England on the SEA Scoping report. Any concerns have been addressed through the EAR and SEA Environmental Report.

Other relevant stakeholders have been consulted during the Drought Plan 2022 consultation period, with any concerns being addressed for the final Drought Plan. Other stakeholders include:

- The Navigation Authority (Canal and River Trust)
- Other abstractors
- Recreational user groups
- Other interested parties

No significant concerns are anticipated for this proposed drought permit, as it has been made available for consultation in previous Drought Plans.

For our full drought permit application we would include the following, as recommended by the guidance:

- Written consent from the Canal and River Trust;
- Comments from those consulted about the application;
- Details of any objections received or agreements reached with objectors;
- A copy of the notices and advertisements relating to our application; and
- A description of our arrangements for the public inspection of the application.

9.4.2 Advertising the application

Our drought permit application would by published in the local newspaper circulating in the area affected by the permit (Gainsborough Standard). The newspaper also has a website. We would also advertise it in the London Gazette, as recommended by the guidance. We would consider publishing targeted social media updates in line with our communications strategy (**Appendix 10**).

9.4.3 Planning for all outcomes

We plan to engage with relevant stakeholders and address concerns in the creation of our Drought Plan and as part of the consultation process. In the event of a public hearing, we would confirm arrangements closer to the time. We have a number of regional Anglian Water offices which could be used as a venue or we would seek alternative venues or online alternatives as appropriate.

We would liaise closely with the Environment Agency before and during any permit application to ensure we have their support. We have agreed a robust mitigation programme with the Environment Agency and do not anticipate significant issues which may result in a public hearing.

In event of unsuccessful permit we would need to consider other supply-side options, such as rezoning or tankering, as well as increasing demand saving activities.

9.4.4 Drought permit review strategy

We would review our need for a drought permit once we enter potential drought status. This will include updating the data that would be needed to inform a permit. Any changes will be fed back into the EARs as required.

Appendices

- Draft permit
- Existing abstraction licence - plus a copy of any statutory instrument or local act connected to it or to a discharge permitted by the drought permit

Supporting Information

- **Appendix 7:** Environmental assessment summary
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Cover photo - Anglian Water's Rutland Water reservoir, a 1,555-hectare biological Site of Special Scientific Interest (SSSI), east of Oakham in Rutland. It was designated a SSSI in 1984.