

Appendix 7

Environmental assessment summary



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1. Introduction

The following report provides a summary of the individual environmental assessments that have been carried out in support of the Drought Plan. This work is also supported by a Strategic Environmental Assessment (SEA) of the Drought Plan and Habitats Regulation Assessment (HRA) relating to protected European sites. The SEA and HRA are presented in separate documents.

Environmental assessments have been carried out for all supply-side drought measures that may require a drought permit. Individual Environmental Assessment Reports (EARs) are available upon request. These have been reviewed and updated for the Drought Plan 2022.

The report describes the methodology that has been followed, and then summarises the individual drought permits and the environmental assessment.

1.1 Background

This report provides a summary of the individual environmental assessments that have been carried out by Ricardo Energy and Environment in support of the Drought Plan 2022 submission, building on the previous assessments conducted by Mott MacDonald / Atkins for Anglian Water's Drought Plan 2019.

The objective of EARs is to provide an independent and robust assessment of the potential environmental effects of the implementation of the drought permit. The assessment focuses on the implications for hydrology, hydrogeology, water quality, ecology and other relevant environmental issues, as well as recreation, navigation, and other abstractors. This includes the identification of environmentally sensitive sites, and includes a monitoring plan and mitigation measures where necessary.

The EARs have been produced to enable AWS to be drought permit 'application ready', and form the basis of an application specific EAR should a drought permit be required in the future. It will be updated at the time of an application to reflect the bespoke nature of the drought at that time.

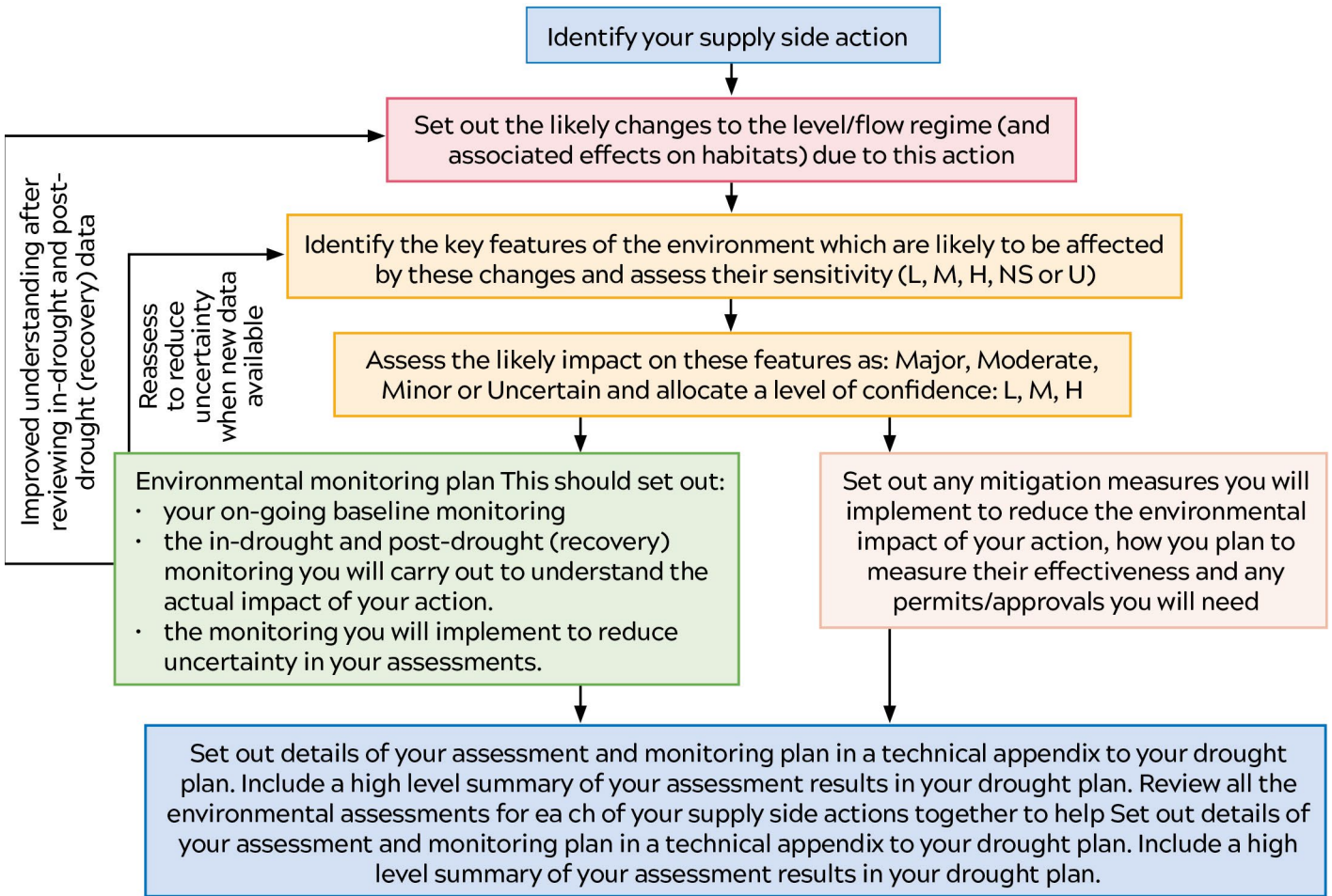
The environmental assessment has been conducted in accordance with Government regulations and using the Environment Agency's 2020 Drought Planning guidance¹ and Environmental Assessment supplementary guidance².

Figure 1.1 is taken from the 2020 guidance and outlines the method for preparing an environmental assessment.

¹ Environment Agency (2020) Water Company Drought Plan guideline, December 2020 (Version 1.2)

² Environment Agency (2020) Environmental Assessment for Water Company Drought Plans - supplementary guidance

Figure 1.1: Approach to environmental assessment



1.2 Purpose of the report

For each of the potential supply-side drought actions detailed within the Drought Plan relating to a requirement for a drought permit, an environmental assessment has been completed following the regulatory guidance. These assessments have been reported separately as follows:

- River Nene intake environmental assessment (Pitsford Water)
- River Nene intake environmental assessment (Rutland Water)
- River Great Ouse intake (Grafham Water) environmental assessment
- River Colne augmentation (Ardleigh Reservoir) environmental assessment

- Wellington Wellfield (Marham) environmental assessment
- River Wensum (Costessey groundwater sources) environmental assessment
- River Trent environmental assessment

The associated monitoring and mitigation requirements are outlined in **Appendix 8** and are not discussed in detail in this Appendix. A separate SEA and HRA has also been carried out.

2. River Nene intake (Pitsford Water)



2.1 Description of potential permit

The proposed drought permit will take the form of a winter or summer authorisation, for the duration of six months at any one time, to allow increased refilling of Pitsford Water through a 50% reduction in the MRF from the River Nene.

The assessment is based on a reduction in MRF from the current 34.1 MI/d to 17.05 MI/d within the period from October to March (inclusive) for a winter permit and April to September (inclusive) for a summer permit.

The permit would be required if there is a risk of compromising our ability to refill Pitsford 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 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.

2.2 Environmental assessment summary

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 HRA Stage 1: Screening Assessment concluded that there are no likely significant effects of the proposed drought permit upon European designated sites.

Monitoring and mitigation measures are required and are outlined in **Appendix 8**. A summary of the predicted impacts of the proposed drought permit is provided in Table 2.1.

Table 2.1: 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.

3. River Nene intake (Rutland Water)



3.1 Description of potential permit

The drought permit may take the form of a winter or summer authorisation, for the duration of six months at any one time, to allow increased refilling of Rutland Water through a 50% reduction in the MRF from the River Nene. It has been assumed that instantaneous, hourly, daily and annual totals would remain unchanged from those currently licensed, therefore the assessment is based on a reduction in MRF from 125 MI/d to 62.5 MI/d for December to April (winter) and 150 MI/d to 75 MI/d for May to November (summer).

The permit would be required 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. However, should drought conditions continue to present a significant risk to supply, a summer drought permit may also be considered as an option.

3.2 Environmental assessment summary

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 2011/2012, 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 Water Recycling Centres.

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. A summary of the potential environmental impacts is given in Table 3.1.

The monitoring and mitigation measures required are outlined in **Appendix 8**.

Table 3.1: Summary of environmental impacts of proposed drought permit in the River Nene (Rutland Water)

River Reach	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

4. River Great Ouse intake (Grafham Water)



4.1 Description of potential permit

The drought permit on the River Great Ouse may take the form of a winter or summer authorisation, for the duration of six months at any one time, to allow increased refilling of Grafham Water through a 50% reduction in the MRF or an increase in the proportion of flow above the MRF that can be abstracted from the Great Ouse. The current licence allows abstraction of 75% of flow in excess of the MRF, subject to licence and pump capacity constraints. It is proposed that a drought permit would be considered in two stages:

- Stage 1: Existing MRF (136 MI/d), abstraction at up to 100% of the flow in excess of the MRF
- Stage 2: Reduced MRF (68 MI/d), abstraction at up to 75% of the flow in excess of the MRF

Stage 2 allows greater abstraction than Stage 1 when the flow is below 340 MI/d⁵, so would 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 licensed.

The permit would be required if there is a risk of compromising our ability to refill Grafham 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 us 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. However, should drought conditions continue to present a significant risk to supply, a summer drought permit may also be considered as an option. Note that summer is defined as April to September (inclusive) and winter as October to March (inclusive).

4.2 Environmental assessment summary

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.

A summary of the predicted impacts of the proposed Stage 1 drought action is provided in Table 4.1, whilst the predicted impacts of a Stage 2 drought action is provided in Table 4.2.

The monitoring and mitigation measures required are outlined in **Appendix 8**.

⁵ 340 MI/d is calculated as the point at which the two permit stages give the same allowable abstraction of 204 MI/d

Table 4.1: Summary of environmental impacts of proposed Stage 1 drought permit in the River Great Ouse

River Reach	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 4.2: Summary of environmental impacts of proposed Stage 2 drought permit in the River Great Ouse

River Reach	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 (all)	Major*	Minor***	Orthophosphate and Ammonia concentrations risk increasing to a level that has potential to impact the WFD status.
	Minor**		Minor**		
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

5. River Colne augmentation (Ardleigh Reservoir)



5.1 Description of potential permit

The drought permit on the River Colne may take the form of a winter or summer authorisation, for the duration of six months at any one time, to allow increased refilling of Ardleigh Reservoir through river augmentation.

Our current licence for the Lower Colne allows us to abstract from four groundwater sources, and discharge it to the River Colne in order to augment the flow at the East Mill intake. The abstraction licence contains water quality conditions to restrict discharge into the River Colne when quality is poor (based on concentrations of chloride, sodium and iron and temperature) and aeration of the abstracted water is required prior to discharge.

The purpose of the proposed drought permit would be to temporarily increase the licensed abstraction at two groundwater sources by 3 Ml/d each to provide additional augmentation to the River Colne. This would increase the peak river augmentation from 12 to 18 Ml/d. There would be no change in the total 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.

5.2 Environmental assessment summary

The environmental assessment study site includes the River Colne from the flow augmentation point at Cook's Mill to the Colne Estuary, a 10 km radius around the abstraction groundwater source, plus the unconfined Chalk to the northwest because changes in abstraction profiles in confined aquifers have been demonstrated to influence stream-unconfined aquifers at a significant distance from the point of abstraction.

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

A summary of the predicted impacts of the proposed drought permit is provided in Table 5.1.

The monitoring and mitigation measures required are outlined in **Appendix 8**.

Table 5.1: Summary of environmental impacts of proposed drought permit in the River Colne

River Reach	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

6. Wellington Wellfield (Marham)



6.1 Description of potential permit

The drought permit at Wellington Wellfield may take the form of a winter or summer authorisation, for the duration of six months at any one time, to maintain supplies to Stoke Ferry Water Treatment Works (WTW) during times of low groundwater levels at our neighbouring Marham groundwater source.

The proposed drought permit increases the annual licensed quantities at two groundwater sources (Wellington Wellfield and Denton Lodge) in order to provide support to Marham groundwater source. The distribution of abstraction between the Wellington Wellfield groundwater sources has been confirmed by recent test pumping and groundwater modelling, undertaken in spring 2021. This has informed the environmental assessment.

The permit will be required when drought conditions require topping up of existing water resources due to reduced availability of water at the Marham groundwater source.

6.2 Environmental assessment summary

The proposed drought action of increased abstraction from the Wellington Wellfield and Denton Lodge groundwater sources during a drought scenario is not thought to significantly impact the ecological integrity of the surrounding area. 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.

Further knowledge of the abstraction licence conditions and infrastructure is being collected in order to quantify this impact.

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.

A summary of the predicted impacts of the proposed drought permit is provided in Table 6.1.

Monitoring and mitigation measures are recommended in **Appendix 8**.

Table 6.1 Summary of environmental impacts of proposed drought permit in the Wellington Wellfield Zone of Influence (Zoi)

Impact	Groundwater Zoi		River Wissey			River Little Ouse		Cut Off Channel	Commentary
	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.

7. River Wensum (Costessey groundwater sources)



7.1 Description of potential permit

The drought permit at the Costessey groundwater sources may take the form of a winter or summer authorisation, for the duration of six months at any one time, to maintain supplies to Heigham WTW during times of low river flows in the River Wensum.

Water is currently abstracted from the River Wensum. When required, a groundwater source is used to supplement water supply.

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.

The proposed drought permit proposes an increase in the maximum annual licensed rate from the groundwater source from 2000 MI/yr to 4800 MI/yr. As per current guidance, the drought permit would cover a 6-month period⁷, and it is understood that reapplication for a further 6 months would be permissible.

A HOF value of 27 MI/d will apply for abstraction from the intake when the licence conditions change in April 2019. A drought permit trigger of 80 MI/d has been used for the assessment; this represents a small operating margin above the HOF plus average abstraction (41.8 MI/d).

7.2 Environmental assessment summary

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.

A summary of the predicted impacts of the proposed drought permit is provided in Table 7.1.

Monitoring and mitigation measures are recommended in **Appendix 8**.

⁷ <https://www.gov.uk/guidance/apply-for-a-drought-permit>

Table 7.1: Summary of environmental impacts of proposed drought permit in the River Wensum, Tud and Yare

River Reach	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	
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	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.

8. River Trent

8.1 Description of potential permit

The drought permit on the River Trent may take the form of a winter or summer authorisation, for the duration of six months at any one time, to maintain supplies to Hall WTW during times of low flows on the River Trent.

The abstraction includes a 15 day bankside storage reservoir. The licence conditions include a Hands Off Flow (HOF) of 1700 MI/d and a Hands Off Level (HOL) of 2.0 mAOD. The HOF is defined at the upstream gauging station of North Muskham because the flow cannot readily be measured in the tidally-influenced reach. The HOL is designed to ensure that the abstraction does not adversely impact navigation.

AWS may seek a drought permit that temporarily reduces the HOF (to 1450 MI/d) during periods of low flow, thereby allowing abstraction to continue in conditions below the current minimum permissible flow. The drought permit will not seek to change the HOL.

The permit would be required if the flows in the Trent reduced to a level that compromised the maintenance of supply.

The 1976 conditions suggest that a trigger threshold of around 2100 MI/d could be used to begin a drought permit application. With this threshold a drought permit might need to be applied for in over 20% of years, but it would nearly always turn out to be unnecessary.

8.2 Environmental assessment summary

The hydrological impact assessment of the implementation of the proposed River Trent drought permit is considered to be a negligible impact on hydrology, even during times of very low flow. As a result, the impacts on receptors was also assessed to be negligible. However, consultation with the Environment Agency outlined concerns over the Humber Estuary SAC and SPA downstream, particularly regarding river and sea lamprey. The features assessment concluded that the drought option would have negligible impact on the conservation objectives for these features, which primarily relate to maintaining water quality and flow conditions. It should be noted that the additional guidance for the Humber Estuary SAC states that Cromwell weir is impassable to lamprey. Impacts to sea and river lamprey arising from the drought option have been considered to be negligible. To address remaining uncertainties, a study into the effect of the drought option on wetted widths will be performed. Lamprey surveys will be added to routine baseline physical environment monitoring that is to be conducted before, during and after a drought event. If baseline monitoring identifies significant changes to the physical environment of the River Trent as a result of the drought permit implementation, then ecological monitoring should be scoped in to inform the mitigation strategy.

A summary of the predicted impacts of the proposed drought permit is provided in Table 8.1.

Monitoring and mitigation measures are recommended in **Appendix 8**.

Table 8.1: Summary of environmental impacts of proposed drought permit in the River Trent

River Reach	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.



Cover photo - Anglian Water's first wetland treatment site, on the River Ingol in west Norfolk. The wetland has been created in partnership with the Norfolk Rivers Trust and forms part of Anglian Water's Water Industry National Environment Programme (WINEP).