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Anglian Water draft Drought Plan 2022

Habitats Regulations Assessment – Stage 1 Screening and Stage 2 Appropriate Assessment Report

Report for Anglian Water Services Ltd

Report for Anglian Water

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Executive summary

Water companies are required to prepare and maintain Statutory Drought Plans every five years, and as part of this process, must ensure the Drought Plan (DP) meets the requirements of the Habitats Regulations. Anglian Water Services Ltd (AWS) is updating its DP 2019 (DP19) published earlier in 2020, which includes the Habitats Regulations Assessment (HRA) and other associated Environmental Assessments. The updated Drought Plan (DP22) will be published as draft in 2021 and final in 2022.

Under Regulations 63 and 105, any plan or project which is likely to have a significant effect on a European site (either alone or in-combination with other plans or projects) and is not directly connected with, or necessary for the management of the site, must be subject to a HRA to determine the implications for the site in view of its Conservation Objectives. For the purposes of the HRA, a European site includes Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites.

AWS has 32 drought options which may result in environmental impact including supply side, demand side, extreme supply side and extreme demand side drought actions. An updated HRA Stage 1 Screening Assessment has been completed to identify if any of the supply side and demand side drought options could lead to Likely Significant Effects (LSEs) on European designated sites. The 'standard' supply and demand side actions remain substantially the same as for the DP19, with no new options except for an additional demand side action and as a result, these have all already been consulted on with the Environment Agency and Natural England. The extreme supply side and extreme demand site drought actions are new but at present are theoretical only and not well defined. Therefore, it is not possible to undertake an HRA assessment of these actions at this time. The HRA Stage 1 Screening concluded that four supply side drought permits (River Great Ouse (Offord Intake), River Nene (Wansford Intake/ Rutland Water), River Wensum (Costessey groundwater sources) and Wellington Wellfield and Denton Lodge (Stoke Ferry Intake)) had potential to cause LSEs on European designated sites alone and they were taken through to Stage 2 Appropriate Assessment. Unlike DP19, the DP22 screening assessments concluded no LSEs for River Trent (Hall Water Treatment Works) drought permit, due to negligible impacts on downstream hydrology.

A Stage 2 Appropriate Assessment was required to determine whether the drought permits would result in an adverse effect on the integrity of European designated sites, in light of Conservation Objectives. It was concluded that with robust monitoring protocol and mitigation measures, that three of the proposed drought permits would not result in an adverse effect on the integrity of European designated sites, either alone or in-combination with other drought options in AWS's draft DP22. These included the River Great Ouse (Offord Intake), River Nene (Wansford Intake/ Rutland Water) and Wellington Wellfield and Denton Lodge (Stoke Ferry Intake).

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. Following the collection of monitoring data and its analysis, the Stage 2 assessment will need to be revisited, to update the outcome and to provide confirmation on the appropriate mitigation measures that could reduce the potential for adverse effects.

In-combination effects of AWS's draft DP22 with AWS's Water Resource Management Plan (WRMP) 2019, the Environment Agency's regional DPs, other water company WRMPs and DPs and other major infrastructure projects are not considered likely to have significant adverse effects on European sites. This assessment is based on information available at the time of writing.

A summary of the conclusions of the HRA Stage 1 Screening Assessment and Stage 2 Appropriate Assessment are provided in **Table A**.

Table A: Summary of HRA Stage 1 Screening Assessment and Stage 2 Appropriate Assessment of Anglian Water's Draft Drought Plan 2022 options.

Drought Option	Is scheme likely to have a significant effect on European site(s) alone?	Effect in-combination with other drought options?	Appropriate Assessment required?	Adverse effect on integrity of European site?
Supply Side Options				
River Colne (Ardleigh Reservoir) drought permit	No	No	No	N/A
River Great Ouse (Offord Intake) drought permit	Yes	No	Yes	No - with monitoring and mitigation measures
River Nene (Pitsford Reservoir/Duston Mill) drought permit	No	No	No	N/A
River Nene (Wansford Intake/ Rutland Water) drought permit	Yes	No	Yes	No - with monitoring and mitigation measures
River Trent (Hall Water Treatment Works) drought permit	No	No	No	N/A
River Wensum (Costessey groundwater sources) drought permit	Yes	No	Yes	Yes
Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) Drought Permit	Yes	No	Yes	No – with monitoring and mitigation measures
Demand Side Options				
Customer metering	No	No	No	N/A
Targeted leakage reduction	No	No	No	N/A
Communication campaigns and messaging	No	No	No	N/A
Water efficiency activities	No	No	No	N/A
Temporary Use Bans	No	No	No	N/A
Non-Essential Use Bans	No	No	No	N/A
Emergency drought orders (rota cuts)	No	No	No	N/A
Extreme Supply Side Options				
Groundwater support	N/A	N/A	N/A	N/A
River support	N/A	N/A	N/A	N/A
Temporary treatment	N/A	N/A	N/A	N/A
Utilising other significant water bodies	N/A	N/A	N/A	N/A
Overland pipes	N/A	N/A	N/A	N/A
Tankering	N/A	N/A	N/A	N/A
Desalination	N/A	N/A	N/A	N/A
Effluent re-use	N/A	N/A	N/A	N/A
Sea tankering	N/A	N/A	N/A	N/A
Resource trading and transfers	N/A	N/A	N/A	N/A
Supply schemes				
Extreme Demand Side Options				
Customer metering	N/A	N/A	N/A	N/A
Household and non-household incentivisation	N/A	N/A	N/A	N/A
Extreme communications plan	N/A	N/A	N/A	N/A
Targeted leakage reduction	N/A	N/A	N/A	N/A
Extreme pressure management	N/A	N/A	N/A	N/A
District metering	N/A	N/A	N/A	N/A
Removal of exceptions	N/A	N/A	N/A	N/A

Table of Contents

Table of Figures

Table of Tables

Glossary

Abbreviation	Definition
CJEU	Court of Justice of the European Union
DP	Drought Plan
DPG	Drought Plan Guideline
EAR	Environmental Assessment Report
EMP	Environmental Monitoring Plan
HRA	Habitats Regulations Assessment
LSE	Likely Significant Effect
NERC	Natural Environment and Rural Communities
REE	Ricardo Energy and Environment
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
UKWIR	UK Water Industry Research
WRMP	Water Resources Management Plan
WRZ	Water Resource Zone

1 Introduction

1.1 Background and purpose of report

Water companies in England and Wales are required to prepare and maintain statutory Drought Plans (DPs) under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003 and subsequently 2014, which set out the short-term operational steps a company will take before, during and after a drought.

Anglian Water Services Ltd (AWS) is currently updating its statutory DP 2019 (DP19) to align with updated guidance, including that provided in the Environment Agency's Drought Plan Guideline (DPG)[1] published in December 2020 (DPG2020). The DPG2020 specifies that a water company must ensure that its DP meets the requirements of the Conservation of the Habitat and Species (Amended) (EU Exit) Regulations 2019 and includes an updated draft of the supplementary guidance on the environmental assessment for water company drought planning (published in July 2020). The DPG2020 indicates that the planned submission date for all draft DP will be March 2021 and final plans to be published by April 2022. The DPG2020 refers to guidance relating to Habitats Regulations Assessment (HRA) that can be used, which includes the UK Water Industry Research (UKWIR) report 'Strategic Environmental Assessment and Habitat Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans'[2]. The UKWIR report recommends that all DPs should be subject to the first stage of HRA, i.e. screening for Likely Significant Effects (LSEs).

The requirement for a HRA is established through Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and Flora (the Habitats Directive). Following the UK leaving the European Union (EU). The European Union (Withdrawal) Act 2018 (as amended[3]) retains existing EU law i.e. the Habitats and Birds Directives. The Directive is transposed into national legislation by The Conservation of Habitats and Species Regulations 2017, as amended, referred to as the Habitats Regulations[4]. It is this legislation, rather than the Directive, that now governs the HRA process within the UK. However, the amendments require that competent authorities continue to comply with and refer to all caselaw preceding 31 December 2020, unless or until modified by domestic appeals and legislation. Under Regulations 63 and 105, any plan or project which is likely to have a significant effect on a European site (either alone or in-combination with other plans or projects) and is not directly connected with, or necessary for the management of the site, must be subject to a HRA to determine the implications for the site in view of its Conservation Objectives.

1.2 Requirement for Habitats Regulations Assessment

The responsibility for undertaking the HRA lies with AWS as the Plan making authority.

HRA Guidance for the appraisal of Plans[5] summarises the Habitats Regulations. Regulation 63 states that the Plan making authority (in this case AWS) shall adopt, or otherwise give effect to, the Plan only after having ascertained that it will not adversely affect the integrity of a European site, subject to

[1] Environment Agency (2020) Water Company Drought Plan Guideline, December 2020.
[2] UKWIR (2021) Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans (21/WR/02/15)
[3] Amended by the European Union (Withdrawal Agreement) Act 2020.
[4] Amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulation 2019.
[5] Tyldesley, D. & Chapman, C. (2013) The Habitats Regulations Assessment Handbook, January 2021 edition UK. DTA Publications Limited.

Regulation 64 or 105 of the Habitats Regulations.

Regulation 64 of the Habitats Regulations states:

(1) If the competent authority is satisfied that, there being no alternative solutions, the plan or project must be carried out for imperative reasons of overriding public interest (which, subject to paragraph (2), may be of a social or economic nature), it may agree to the plan or project notwithstanding a negative assessment of the implications for the European site or the European offshore marine site (as the case may be).

(2) Where the site concerned hosts a priority natural habitat type or a priority species, the reasons referred to in paragraph (1) must be either—

(a)reasons relating to human health, public safety or beneficial consequences of primary importance to the environment; or

(b)any other reasons which the competent authority, having due regard to the opinion of the appropriate authority, considers to be imperative reasons of overriding public interest.

Regulation 105 of the Habitats Regulations states:

(1) Where a land use plan—

(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in-combination with other plans or projects), and

(b) is not directly connected with or necessary to the management of the site,

the plan-making authority for that plan must, before the plan is given effect, make an appropriate assessment of the implications for the site in view of that site's Conservation Objectives.

(2) The plan-making authority must for the purposes of the assessment consult the appropriate nature conservation body and have regard to any representations made by that body within such reasonable time as the authority specifies.

(3) The plan-making authority must also, if it considers it appropriate, take the opinion of the general public, and if it does so, it must take such steps for that purpose as it considers appropriate.

(4) In the light of the conclusions of the assessment, and subject to regulation 107, the plan-making authority must give effect to the land use plan only after having ascertained that it will not adversely affect the integrity of the European site or the European offshore marine site (as the case may be).

(5) A plan-making authority must provide such information as the appropriate authority may reasonably require for the purposes of the discharge by the appropriate authority of its obligations under this Chapter.

(6) This regulation does not apply in relation to a site which is—

(a)a European site by reason of regulation 8(1)(c), or

(b)a European offshore marine site by reason of regulation 18(c) of the Offshore Marine Conservation Regulations (site protected in accordance with Article 5(4) of the Habitats Directive).

Guidance provided in the HRA Handbook[6] recommends that if there are no alternative solutions and if, in exceptional circumstances, it is proposed that a Plan be adopted despite the fact that it may adversely affect the integrity of a European site, the HRA will need to outline the Imperative Reasons of Overriding Public Interest (IROPI) which the Plan making authority considers to be sufficient to outweigh the potentially adverse effects on the European site(s).

[6] Tyldesley, D. & Chapman, C. (2013). The Habitats Regulations Assessment Handbook, January 2021 edition UK: DTA Publications Limited.

1.3 Approach to HRA

The HRA of the AWS draft DP22 has been undertaken in four stages:

1. Firstly, a screening process is undertaken to identify whether each drought option in AWS DP (either alone or in-combination with other plans or projects) is likely to have significant effects on European sites.

2. Where a significant effect is likely (noting the precautionary principle), an Appropriate Assessment will then be undertaken of the drought option to determine whether this would adversely affect the integrity of the European site(s), either alone or in-combination with other plans and projects, taking into account available mitigation measures.

3. Where significant adverse effects are identified at the Appropriate Assessment stage, alternative options would be examined to avoid any potential significant effects on the integrity of the European site as Stage 3 of the HRA.

4. Stage 4 comprises an assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest, it is deemed that the Plan should proceed.

The HRA has been undertaken in accordance with currently available guidance[6][7][8][9][10] and has been based on a precautionary approach as required under the Habitats Regulations. It has followed the staged HRA approach, commencing with the Stage 1 screening of all options contained within the DP.

The assessment refers to the LSE of an option on one or more European sites, including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) (also known as National Site Network).

- SPAs are classified under the European Council Directive 'on the conservation of wild birds' (2009/147/EC; 'Birds Directive') for the protection of **wild birds and their habitats** (including particularly rare and vulnerable species listed in Annex 1 of the Birds Directive, and migratory species).

- SACs are designated under the Habitats Directive (92/43/EEC) and target particular **habitats** (Annex 1) **and/or species** (Annex II) identified as being of European importance.

- The Government also expects potential SPAs (pSPAs), candidate SACs (cSACs), compensation habitat and Ramsar sites to be included within the assessment.

Many designated Wetlands of International Importance support important wetland habitats and are listed under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention, 1971). These wetlands are known as Ramsar sites and often overlap with SACs and SPAs that may be designated for the same or different species and habitats. All Ramsar sites

[7] Court of Justice for the European Union's ruling on People Over Wind and Sweetman ('Sweetman II') vs Coillte Teoranta, Case C-323/17.
[8] UK Government (2019). Guidance on the use of Habitats Regulations Assessment.
[9] UK Government (2019). Conservation of Habitats and Species Regulations (Amendment) (EU Exit).
[10] Natural England (2020). Guidance on how to use Natural England's Conservation Advice Packages in Environmental Assessments.

therefore require the same level of assessment as SPAs and SACs. For ease of reference through the HRA process, these designations are collectively referred to as European sites, despite Ramsar designations being made at the international level.

The purpose of the screening stage is to determine whether any part of the plan in question (in this case the draft DP22) is likely to have a significant effect on any European site. This is judged in terms of the implications of the plan for a site's Conservation Objectives, which relate to its 'qualifying features' (i.e. those Annex I habitats, Annex II species, and Annex I bird populations[11], or Ramsar criterion, for which it has been designated). Significantly, HRA is based on a rigorous application of the precautionary principle. Where uncertainty or doubt remains, an impact should be assumed, triggering the requirement for Appropriate Assessment of that scheme.

The screening stage also has to conclude whether any in-combination effects would result from the schemes within the plan itself, or from the plan in-combination with other plans and projects, for example neighbouring water companies' DPs and Water Resource Management Plans (WRMPs), and whether these would adversely affect the integrity of a European site.

This document reports the HRA Stage 1 Screening and Stage 2 Appropriate Assessment of AWS draft DP22. HRA Screening identifies whether the drought options contained within AWS draft DP22 will have LSEs on European sites and as such, determines the requirement for Appropriate Assessment.

In April 2018[12], there was an important judgement in the Court of Justice of the European Union (CJEU) which ruled that Article 6(3) of the Habitats Directive must be interpreted as meaning that mitigation measures should be assessed within the framework of an Appropriate Assessment and that it is not permissible to take account of mitigation measures at the screening stage. Considering this judgement, the implications have been taken into account as part of the HRA screening process in support of the draft DP22.

AWS will also undertake a Strategic Environmental Assessment (SEA) of their draft DP22. The SEA is being undertaken in parallel with the HRA assessment and will be reported separately.

1.4 Anglian Water Supply System and Drought Planning

AWS uses a combination of groundwater and surface water sources for abstraction, which include multiple storage reservoirs (Rutland Water, Grafham Water, Pitsford Water, Alton Water, Covenham Reservoir and Ardleigh Reservoir), natural catchment reservoirs and eight river intakes. On average they abstract 1,100 Ml/d for storage and treatment, which during high demand can increase to an estimated 1,400 Ml/d.

Water Resources Management Plan (WRMP)

AWS sets out how it will maintain planned levels of service in its WRMP. The latest WRMP was published in 2019 and sets out a "twin-track" approach of demand management measures together with timely development of new water sources to ensure a positive supply/ demand balance during prolonged dry weather. For the WRMP19, the region has been subdivided into 28 Water Resource

[11] Annexes are contained within the relevant EC Directive.
[12] Court of Justice of the European Union Case C-323/17: People over Wind & Sweetman v Coillte Teoranta

Zones (WRZs), each with their own supply and demand challenges[13]. The WRMP19 sets out the actions AWS will take to maintain its customer levels of service for water supply reliability, in particular planning for a temporary use ban and/or a non-essential use ban on selected water uses to only be implemented, on average, once in every 20 years and planning with the objective that rota cuts or standpipes should not be required.

Drought Plan (DP)

The AWS DP complements the WRMP and is focused on the actions that AWS will take during drought conditions, when there are increased risks of temporary water use restrictions being required along with implementing temporary measures to augment water supply availability, in order to maintain essential water supplies to all customers.

Water companies in England and Wales are required to prepare and maintain statutory DPs under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003 and in accordance with the DP Regulations 2005 and the DP Direction 2020.

The Water Industry Act 1991 defines a DP as *'a plan for how the water undertaker will continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water, with as little recourse as reasonably possible to drought orders or drought permits'*.

On 1 October 2010, Section 76 of the Water Industry Act 1991 was amended by the commencement of Section 36 of the Flood and Water Management Act 2010. The Water Use (Temporary Bans) Order 2010 also commenced on 1 October 2010 and provides definitions and clarifications on these activities. The DP Direction 2020 states that all water company draft DPs should be sent to the Secretary of State prior to consultation before 1 April 2021. Water companies must then publish their DP as directed by Defra. A revised (final) DP must be published at least every 5 years from the date the previous DP was published.

AWS's current Final DP19 covers the period 2019 – 2024. AWS is currently updating the statutory DP19 which includes associated Environmental Assessments, to be published as draft in 2021 and final in 2022. The period encompassed by the draft DP22 will be from 2022 - 2027. The next revision of the DP would be published in 2027/28.

Only those drought options which are relevant to the period encompassed by the draft DP22 are considered in the HRA process. To this end, environmental effects of the draft DP22 options are considered within the context of the current licence operating conditions. Potential new sources (which AWS may bring online in the future), new drought options, or revisions to existing options which are only envisaged to become operational post 2027 have, therefore, been excluded from the SEA and HRA screening process. The same approach has also been undertaken for in-combination effects with other projects and programmes, in that only those that are likely to be effective in the period to 2027 were considered in the HRA and SEA.

[13] Anglian Water (2019). Water Resources Management Plan 2019. Anglian Water, 1 – 90.

1.5 Anglian Water Drought Actions

1.5.1 Supply Side Actions

The supply side actions proposed within the draft DP22 are associated with the development of potential options to help improve outputs from existing water sources. Reservoir options seek to conserve or increase the amount of water stored (and therefore available for supply) during a drought period, and direct intakes seek to supplement water supply, and in some cases, to help conserve reservoir storage. Groundwater options seek to supplement water supply.

The supply side drought measures outlined in the draft DP22 will need to be implemented through drought permits. Under drought conditions, where a serious deficiency of supplies threatens to occur, or already exists, AWS may require recourse to drought orders in order to increase supplies to manage the supply-demand balance. These are emergency options that would need to be further explored with the Environment Agency or neighbouring water companies to clarify the requirements for environmental assessment in advance of Drought Order application. Therefore, only drought permits, as identified in Table 1.1, have been assessed as part of the HRA screening.

For existing water sources, drought permits are used to increase the amount of water that can be abstracted to supplement supplies and, where possible, to conserve reservoir storage. AWS may also apply for drought permits increase winter abstractions. If confirmed, drought permits may only be authorised for specified six-month (winter or summer) periods, subject to renewal only for further limited periods.

The draft DP22 includes seven supply side options that would require a drought permit (**Figure 1.1**). Individual environmental assessments have been carried out for each of the potential drought permit option using a structured approach, in line with the Environment Agency's Drought Plan Guideline[14]. These environmental assessments will be used to inform the HRA.

All options were included in the previous DP19 and therefore, were considered in the previous HRA. The Alton Water drought permit option has been removed from the draft DP22. The proposed drought permit options for Alton were reviewed with the Environment Agency and the decision was made to remove the Alton drought permit from this DP. More information regarding this decision is detailed in Appendix 9 of the DP.

[14] Environment Agency (2020) Water Company Drought Plan guideline, December 2020 (Version 1.2).

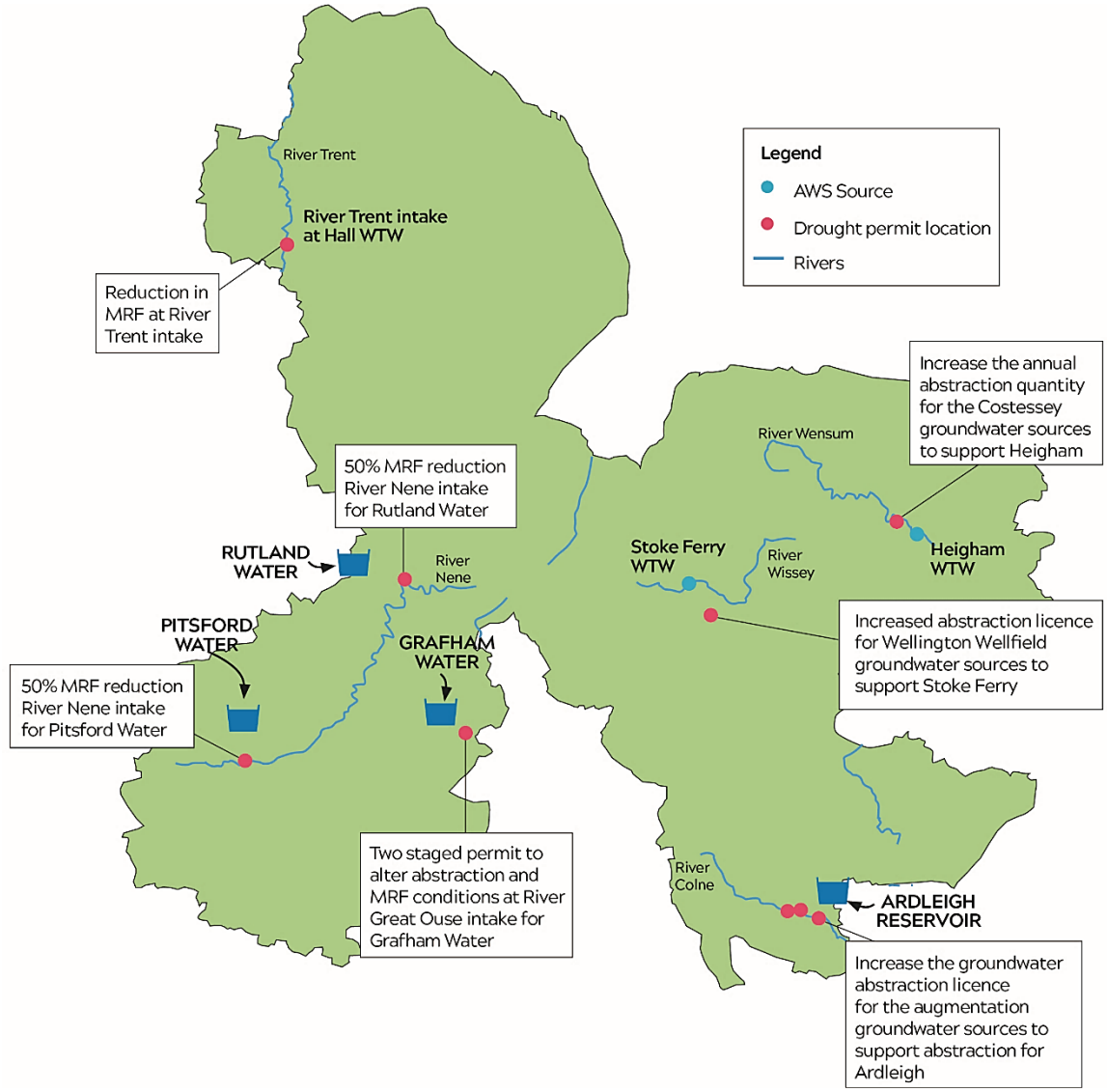

Figure 1.1 Anglian Water drought permit locations and associated sources for the draft Drought Plan 2022.

Potential drought permit sites are identified and described in Table 1.1 below for the draft DP22**.**

Table 1.1: Supply side drought permit options.

Drought permit	Water Source	Description
River Colne (Ardleigh Reservoir) drought permit	Aldham and Balkerne groundwater sources – River Colne	Increase the licensed abstraction by 3 Ml/d each to provide additional augmentation to the River Colne. Used flexibly throughout the year for three months, to support Ardleigh Reservoir when drought conditions are experienced.
River Great Ouse (Offord Intake) drought permit	River Great Ouse	Increase refilling of Grafham Reservoir, through an increase in the proportion of flow above the minimum residual flow (MRF) that can be abstracted (Stage 1) followed by a 50% reduction in the MRF (Stage 2).
River Nene (Pitsford Reservoir/Duston Mill) drought permit	River Nene	Increased filling of Pitsford Reservoir through a reduction of up to 50% in the MRF from the current 34.1 Ml/d to 17.05 Ml/d within the period from October to March (inclusive) for a winter permit and April to September (inclusive) for a summer permit.
River Nene (Wansford Intake/ Rutland Water) drought permit	River Nene	Increase refilling of Rutland Water through a 50% reduction in the MRF from 125 Ml/d for December to April and 150 Ml/d for May to November to 62.5 Ml/d for December to April and 75 Ml/d for May to November.
River Trent (Hall Water Treatment Works) drought permit	River Trent	Temporary reduction in the Hands-off Flow (HoF) (to 1450 Ml/d) during periods of low flow. This will allow abstraction to continue in conditions below the current minimum permissible flow.
River Wensum (Costessey groundwater sources) drought permit	Costessey groundwater sources	Temporary increase in the maximum annual licensed abstraction rate from the groundwater sources when flows in the river Wensum are low from 2000 Ml/yr to 4800 Ml/yr.
Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit	Wellington Wellfield & Denton Lodge groundwater sources	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 Increase the annual licence quality to 4575 Ml (an additional 2747.5 Ml) for the six months of the permit.

1.5.2 Demand Side Actions

AWS can also introduce a number of 'standard' demand side measures during a period of drought. This could include activities such as:

- Customer metering
- Targeted leakage reduction
- Communication campaigns and messaging
- Water efficiency activities
- Temporary Use Bans
- Non-Essential Use Bans
- Emergency drought orders (rota cuts)

1.5.3 Extreme Supply and Demand Actions

There are some potential extreme supply and demand side management actions that may be considered during a drought to mitigate the need for standpipes and rota-cuts in an emergency situation. AWS is currently completing further consideration of such options to provide supply benefits before a Level of Service (LoS) 4 trigger is crossed. They are also known as 'more before 4' actions. At present these options are theoretical only and include:

Extreme supply-side options

- Groundwater support
- River support
- Temporary treatment
- Utilising other significant water bodies
- Overland pipes
- Tankering
- Desalination
- Effluent re-use
- Sea tankering
- Resource trading and transfers
- Supply schemes (e.g acceleration of the strategic grid scheme)

Extreme demand-side options

- Customer metering (standard and smart)
- Household and non-household incentivisation (e.g provide financial reward to customers who reduce their water usage and water efficiency schemes)
- Extreme communications plan (e.g keep customers aware of current storage situation, guides for customers to show how to restrict water use to 50 litres/person/day)
- Targeted leakage reduction
- Extreme pressure management (this could include further reducing pressure while still maintaining essential services or night-time reductions)
- District metering
- Removal of exceptions (e.g under Temporary Use Bans or Non-Essential Use Bans that are implemented)

1.5.4 Supporting Information

Drought options included in the HRA screening will be documented by AWS in the draft DP22 and relevant Appendices.

It is noted that some drought options may have different environmental effects depending on the season of implementation (for example a summer vs a winter drought). As drought measures can theoretically be required and implemented at any time of year, overall impacts have been assessed where possible on a worst-case basis.

Environmental assessment studies of AWS drought permit / order sites have been carried out and information from these studies will be used to inform the HRA.

1.6 Consultation for DP19

In line with guidance, AWS carried out an eight-week public consultation (22 February 2019 – 19 April 2019) following confirmation from the Secretary of State to publish DP19. This was shared with statutory consultees including the Environment Agency, Natural England and Defra, as well as key stakeholders

such as inset suppliers and customers. A summary Statement of Response to outline any changes made in response to the consultation was published on AWS website with the revised draft DP in June 2019. The revised draft DP19 was sent to the Secretary of State for permission to publish, which was granted and the final DP19 was published in May 2020[15].

Relevant representations from this consultation have been considered in the update of this HRA, as well as wider feedback received from the Environment Agency and Natural England on the DP19 environmental assessments.

1.7 Consultation for Drought Plan 2022

The DPG 2020 requires water companies to discuss the environmental assessments, mitigation measures and monitoring plans as early as possible with the Environment Agency and Natural England, when developing a drought plan. This should be part of the preliminary discussions held with regulators, other organisations and individuals who could be affected by drought management actions.

The DPG 2020 requires Natural England to be engaged where a plan is likely to affect protected sites (e.g. National Site Network and SSSIs) in England. The DPG also requires a water company to contact the relevant National Park Authority (including the Broads Authority) about any actions that will take place within their boundaries and relevant local authorities in relation to Local Wildlife Sites.

To ensure the stakeholder and regulatory engagement requirements are met, AWS will continue to actively engage with regulators and other stakeholders during the preparation of DP22 environmental assessments. The proposed engagement plan is listed below in **Table 1.2.** This will be supplemented by feedback received from the Environment Agency and Natural England on the DP19 environmental assessments.

Table 1.2 Stakeholder/ regulatory engagement

Date	Regulator/ stakeholder	Type	Aim of meeting/correspondence
24th November 2020	Environment Agency (all areas)	Teleconference	Discuss methodology and programme
7th January 2021	Environment Agency (all areas)	Teleconference	Presentation of Zone of Influence updates
1st February 2021	Environment Agency, Natural England and Historic England	Formal 5-week consultation period	Statutory consultees to provide comments on SEA Scoping Report
17th February 2021	Environment Agency	Teleconference	Discussion of comments on methodology
25th February 2021	Environment Agency and Natural England	Teleconference	Discussion of the SEA scoping consultation and key comments
16 June 2021	Historic England	Formal consultation period	Statutory consultees to provide comments on the HRA Report
25 June 2021	Environment Agency	Formal consultation period	Statutory consultees to provide comments on the HRA Report
30 July 2021	Natural England	Formal consultation period	Statutory consultees to provide comments on the HRA Report
23 August 2021	Natural England	Teleconference	Discussion of comments on the HRA Report
July-September 2021	Environment Agency	Emails, teleconference	Discussion of comments on methodology

[15] Anglian Water Services Ltd (2020). Drought Plan 2019, final version. Anglian Water, 1 – 75.

1.8 Structure of report

The report is divided into the following sections:

Section 1: Introduction
Section 2: Methodology
Section 3: HRA Screening of Drought Options
Section 4: Information to Inform Stage 2 Appropriate Assessment
Section 5: Stage 2 Appropriate Assessment
Section 6: Potential In-Combination Effects with Other Plans and Projects
Section 7: Conclusions and Recommendations

2 Methodology

The objective of the HRA is to establish firstly whether schemes included in draft DP22 are likely to have a significant effect on European sites (alone or in-combination with other supply schemes in the plan, or with other plans and projects), and secondly, where a significant effect is likely, to determine through Appropriate Assessment, whether the plan would adversely affect the integrity of the European site(s).

HRA screening was therefore completed for all of the drought options considered in the development of the draft DP22. The demand management schemes are unlikely to have any effects on European sites as they comprise measures which will not result in any new development or water abstraction (repairing leakage and water efficiency measures) and which are largely implemented within urban areas. However, they have still been subject to the HRA screening process, the results of which are included in **Section 3**. There are some potential extreme supply and demand side management options that may be considered during a drought to mitigate the need for standpipes and rota-cuts in an emergency situation. AWS is currently completing further consideration of such options to provide supply benefits before a Level of Service (LoS) 4 trigger is crossed. They are also known as ‘more before 4’ actions. At present these options are theoretical only and are not well defined, and therefore it is not possible to undertake an HRA assessment of these actions. Further work to define the feasibility and scope of these options is ongoing.

2.1 Identification of European Sites for Assessment

To provide an indication of those options more likely to have a significant effect on a European site(s), those options that are within 10km of a European site were identified. Consideration was also given to the relative locations of options and designated sites within the same surface and groundwater catchments (where this information was available) to ensure that any connectivity over a longer distance that might affect water-dependent sites was taken into account. GIS data were used to map the locations and boundaries of European sites within or adjacent to the AWS Drought Permits using publicly available data from Natural England. European sites and drought permits are shown in **Figure 2.1.**

The attributes of European sites, which contribute to and define their integrity, were considered with

reference to Standard Data forms for SACs and SPAs and Information Sheets for Ramsar sites[16].

The data sources that were considered include:

- Relevant citation documents;
- Conservation Objectives (SACs and SPAs) and Supplementary Advice on Conservation Objectives (where available) including the targets and attributes that inform favourable condition status;
- Site Improvement Plans (SACs and SPAs);
- Regulation 33 information for European Marine Sites;
- Review of Consents information available from the Environment Agency;
- Favourable condition tables for Sites of Special Scientific Interest (SSSI) (where available);
- Article 12 (SPAs) and Article 17 (SACs) status reports;
- SSSI condition assessments;
- Common Standards Monitoring Guidance (where specific targets have been set and agreed by Natural England and Environment Agency);
- Habitat preferences for the qualifying species (e.g. nesting, foraging, commuting) and food preferences; and
- Physical characteristics of the habitats and environment influencing them.

A summary of the qualifying features within each European designated site included in this HRA and associated threats and pressures (in Site Improvement Plans) are provided in Appendix A1. This information allows identification of those features of each site which determine site integrity and the specific sensitivities of the site, as well as an analysis of how potential impacts of the drought options may affect site integrity.

[16] These were obtained from the Joint Nature Conservation Committee and Natural England websites (www.jncc.gov.uk and www.naturalengland.org.uk).

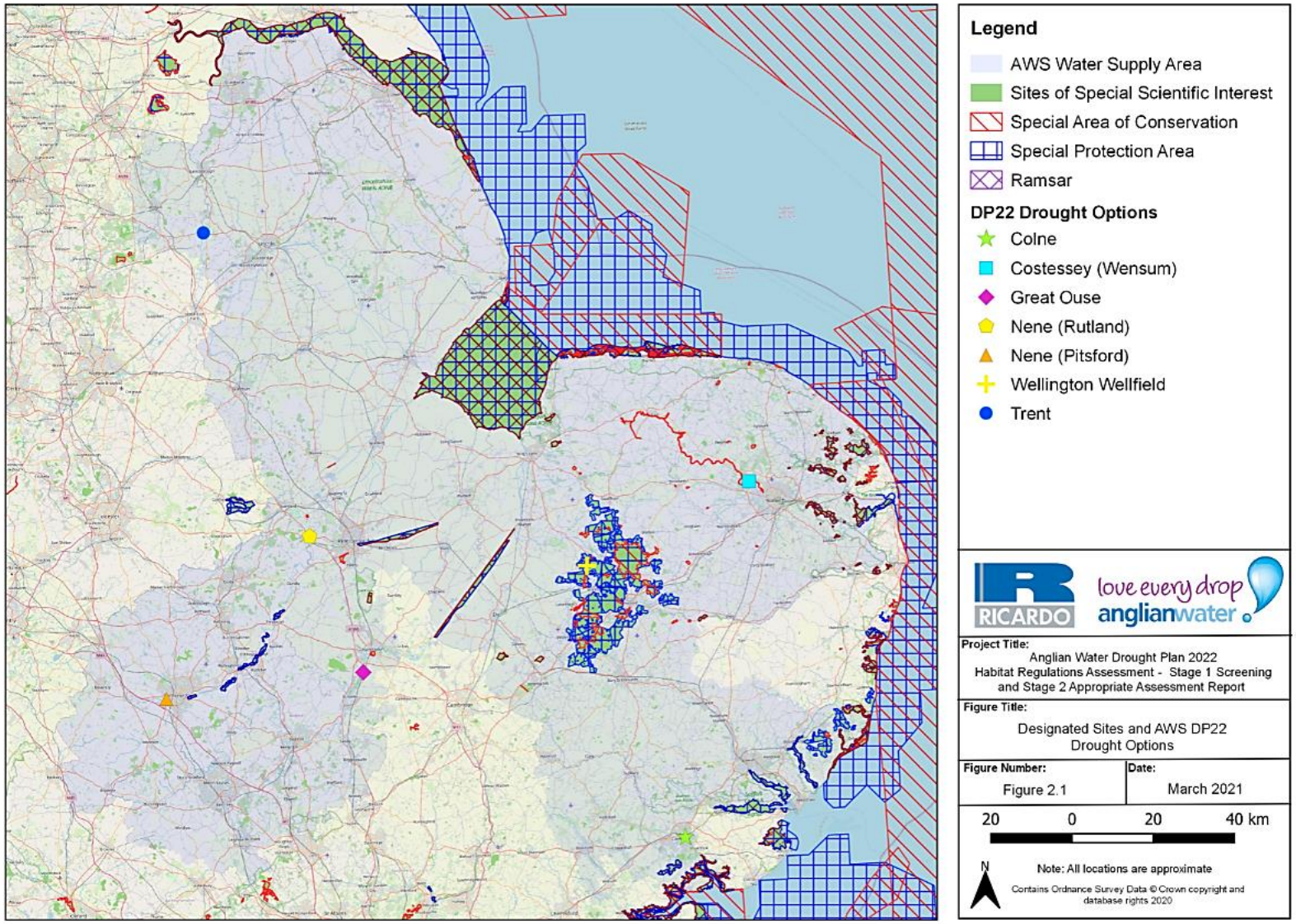

Figure 2.1: Anglian Water's draft Drought Plan 2022 options and water supply area in relation to European/ National designated sites.

2.1.1 Managed Wetlands

Until recently, many existing abstractions that were exempt from requiring an abstraction licence. Natural England have indicated that following the implementation of the Water Act of 2003 such exemptions will no longer be in place. This included abstractions from watercourses to manage wetlands and designated sites. For a new abstraction licence for a previously exempt abstraction (also known as a new authorisation), the Environment Agency set a deadline of 2 years from 1 January 2018 to apply for a licence. It could take a further three years for each application to be determined

The potential impacts of the implementation of a drought permit on designated sites has been undertaken for each drought option as part of Environmental Assessment Reports (EARs) (see **Section 2.3** below). This includes consideration of the effect of the implementation of a drought permit/order on the abstraction of water for managed wetlands and the conservation of such wetlands. However, at this stage, any exceptions are still in place and no licences have been issued. As a result, a detailed assessment of the effect of a drought permit/order on the abstraction of water for managed wetlands will need to be determined at the time of implementation of a permit/ order.

2.2 Potential impacts of the options considered in the Drought Plan

The qualifying habitats and species of European sites are vulnerable to a wide range of impacts such as physical loss or damage of habitat, disturbance from noise, light, human presence, changes in hydrology (e.g. changes in water levels/flow, flooding), changes in water or air quality and biological disturbance (e.g. direct mortality, introduction of disease or non-native species).

In determining the likelihood of significant effects on European sites from the supply side drought permit options, demand side options, extreme supply side options and extreme demand side options, particular consideration has been given to the possible source-receptor pathways through which effects may be transmitted from activities associated with drought plan options to features contributing to the integrity of the European sites (e.g. groundwater or surface water catchments, air etc). Table 2.1 shows the type of impacts drought options could have on European site qualifying features.

Screening for LSEs has been determined on a proximity basis for many of the types of impacts, based on the proximity of the drought option location to each European site. However, there are many uncertainties associated with using set distances as there are very few standards available as a guide to how far impacts will extend. Different types of impacts can occur over different distances, and the assumptions and distances used in this HRA and justification for them are shown in Table 2.1 below**.**

Table 2.1 Potential impact pathways of drought options on European designated sites[17].

Broad categories of potential impacts on European Sites, with examples	Examples of activities responsible for impacts *(example distance considerations in italics)*
Physical loss: • Removal • Smothering	**Development of infrastructure associated with option**, e.g. new or temporary pipelines, transport infrastructure, temporary weirs. **Indirect effects from a reduction in flows** e.g. drying out of water-margin habitat. *Physical loss is likely to be significant where the boundary of the option extends within or is directly adjacent to the boundary of the European Site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European Site is designated, or where natural processes link the option to the site, such as through hydrological connectivity downstream of an option, long shore drift along the coast, or the option impacts the linking habitat).*
Physical damage: • Sedimentation/silting • Prevention of natural processes • Habitat degradation • Erosion • Fragmentation • Severance/barrier effect • Edge effects	**Construction activity leading to permanent and/or temporary damage of available habitat, sedimentation/siltation, fragmentation, etc.** *Physical damage is likely to be significant where the boundary of the option extends within or is directly adjacent to the boundary of the European Site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat that supports species for which a European Site is designated, or where natural processes link the option to the site, such as through hydrological connectivity downstream of an option or sediment drift along the coast.*
Non-physical disturbance: • Noise • Visual presence • Human presence • Light pollution	**Noise from temporary construction or temporary pumping activities**. *Taking into consideration the noise level generated from general building activity (c. 122dB(A)) and considering the lowest noise level identified in appropriate guidance as likely to cause disturbance to estuarine bird species, it is concluded that noise impacts could be significant up to 1km from the boundary of the European Site*[18,19,20] **Noise from vehicular traffic during operation of an option**. *Noise from construction traffic is only likely to be significant where the transport route to and from the option is within 3-5km of the boundary of the European Site*[21]*.* **Plant and personnel involved in in operation of the option**. *These effects (noise, visual/human presence) are only likely to be significant where the boundary of the option extends within or is adjacent to the boundary of the European Site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European Site is designated).* **Options that might include artificial lighting**, e.g. for security around a temporary pumping station. *Effects from light pollution*[22] *are more likely to be significant where the boundary of the option is within 500m of the boundary of the European Site.*
Water table/availability: • Drying • Flooding/stormwater • Changes to surface water levels and flows	**Changes to water levels and flows due to increased water abstraction, reduced storage, or reduced flow releases from reservoirs to river systems. Potential for changes to habitat availability, for example**

[17] Taken from UKWIR (2021) Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans. (21/WR/02/15)
[18] Environment Agency (2013) Bird Disturbance from Flood and Coastal Risk Management Construction Activities. Overarching Interpretive Summary Report. Prepared by Cascade Consulting and Institute of Estuarine and Coastal Studies.
[19] Cutts N, Hemingway K and Spencer J (2013) The Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning and Construction Projects. Produced by the Institute of Estuarine and Coastal Studies (IECS). Version 3.2.
[20] Waterbird Disturbance & Mitigation Toolkit. TIDE toolbox - TIDE tools (tide-toolbox.eu)
[21] British Standards Institute (BSI) (2009) BS5228 - Noise and Vibration Control on Construction and Open Sites. BSI, London.
[22] Institute of Lighting Professionals (2020) Guidance Notes for the Reduction of Obtrusive Light GN01/20.

Broad categories of potential impacts on European Sites, with examples	Examples of activities responsible for impacts *(example distance considerations in italics)*
• Changes in groundwater levels and flows • Changes to coastal water movement	**reductions in wetted width of rivers leading to desiccation of macrophyte beds.** *These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European Site. However, these effects are dependent on hydrological continuity between the option and the European Site, and sometimes whether the option is up or down stream from the European Site.*
Toxic contamination: • Water pollution • Soil contamination • Air Pollution	**Reduced dilution in downstream or receiving waterbodies due to changes in abstraction or reduced compensation flow releases to river systems.** *These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European Site. However, these effects are dependent on hydrological continuity between the option and the European Site, and sometimes whether the option is up or down stream from the European Site.* **Air emissions associated with plant and vehicular traffic during construction and operation of options.** *The effect of dust is only likely to be significant where site is within or in close proximity to the boundary of the European Site*[23,24]*. Without mitigation, dust and dirt from the construction site may be transported onto the public road network and then deposited/spread by vehicles on roads up to 500m from large sites, 200m from medium sites, and 50m from small sites as measured from the site exit.* *Effects of road traffic emissions from the transport route to be taken by the project traffic are only likely to be significant where the protected site falls within 200 metres of the edge of a road affected*[25]*.*
Non-toxic contamination: • Nutrient enrichment (e.g. of soils and water) • Algal blooms • Changes in salinity • Changes in thermal regime • Changes in turbidity • Changes in sedimentation/silting	**Changes to water salinity, nutrient levels, turbidity, thermal regime due to increased water abstraction, discharges, storage, or reduced compensation flow releases to river systems.** *These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European Site. However, these effects are dependent on hydrological continuity between the option and the European Site, and sometimes whether the option is up or down stream from the European Site.*
Biological disturbance: • Direct mortality • Changes to habitat availability • Out-competition by non-native species • Selective extraction of species • Introduction of disease • Rapid population fluctuations • Natural succession	**Killing or injury due to construction activity.** *Likely to be a risk where the boundary of the option extends within or is directly adjacent to the boundary of the European Site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European Site is designated).* **Creation of new pathway for spread of non-native invasive species.** *This effect is only likely to be significant where the option is situated within the European Site or an upstream tributary of the European Site, but also for inter-catchment water transfers.*

Construction phase and operational phase impacts were reviewed and assessed. Most of the drought permit/order options reviewed comprise a change to an existing abstraction licence, with little or no requirement for additional infrastructure, and as such, few of these options can be considered to have

[23] Highways Agency (2003) Design Manual for Roads and Bridges (DMRB), Volume 11.
[24] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction v1.1.
[25] NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018.

a 'construction' phase.

The HRA Screening process was undertaken using professional judgement taking into account potential extent, complexity, duration, frequency, reversibility and probability of impacts.

Where uncertainty remains after screening, and it cannot be concluded that a drought option is not likely to have significant effects on the qualifying features of a European site, the drought option should be taken forward to Stage 2, which requires a full Appropriate Assessment of that option to be undertaken.

2.3 Drought Plan Environmental Assessments

Environmental Assessment Reports (EARs) are being prepared for the drought permit sites identified in **Table 1.1,** to support AWS's draft DP22. The aim of these studies is to produce environmental impact assessments that have been agreed with the Environment Agency and Natural England such that in the event of a drought, they are readily available for updating based on the prevailing drought situation at that time.

The EARs consider all potentially affected habitats and species including, but not limited to, SACs, SPAs and Ramsar features as well as any SSSI or species/habitats of principal importance for the conservation of biodiversity in England (identified in the Natural Environment and Rural Communities (NERC) Act 2006 Section 41). The reports also include Environmental Monitoring Plan (EMP) recommendations for each drought permit/order site. These environmental assessments are undertaken using a theoretical worst-case actual drought event, and as such are intended to be used as the basis for understanding the environmental impacts of the permit under a standard six-month drought permit application. They are designed to support a bespoke EAR to which would be prepared in support of a specific drought permit / order application, should the need arise.

The EARs also contain a hydrological or hydrogeological impact assessment, which informs the expected Zone of Influence (ZoI) of the drought permit / order. The ZoI or study area associated with each drought option is defined through hydrological effects, taken as the point of permit condition change (e.g. location of abstraction) to the point at which the change in river flow or groundwater level change compared the baseline without a drought action has reduced to negligible.

Hydrogeological impact has been assessed through groundwater modelling. The DPG does not provide a methodology for identifying the hydrological impact. Ricardo has therefore developed a 'river flow regime reference conditions and likely changes approach' which uses the daily flow regime in each relevant reach to describe the reference (baseline) conditions and from which to describe and quantify the likely change from each drought action and subsequent impact on ecology and wider environment[26].

Core to the assessment approach is the use of relevant flow statistics to inform the scale of hydrological impact. Potential changes in flow resulting from implementation of the drought option, are used to determine the scale of potential impact at any particular environment site / feature using defined matrices. Using a starting point of percentage flow reduction, these consider the inherent environmental sensitivity of lowland rivers to flow changes (wetted width, depth and velocity). Within the overall zone of influence, reaches are typically defined on a hydrological basis[27] by the addition of flow from a

[26] Ricardo Energy & Environment (2021). Anglian Water Drought Plan 2022. Environmental Assessment Methodology. Report for Anglian Water Services. January 2021.

[27] On occasion, reaches can also be allocated based on geomorphological or water quality characteristics, and the extent of these will be set out in individual EARs, where appropriate.

significant tributary or discharge where the significant flow increase may cause the hydrological impact of the drought option to reduce.

2.4 Review of Potential In-combination Effects

Regulation 63 requires that a competent authority considers the likely significant effect on a European site as a result of a plan or project alone or in-combination with other plans or projects.

The review has therefore considered the in-combination effects of the drought options in the AWS draft DP22 and the in-combination effects of the draft DP22 with a number of plans and projects that could have an impact on the European sites identified within this HRA, as follows:

- Inter-option effects within AWS draft DP22
- AWS WRMP19
- Other water company WRMPs and DPs
- Anglian River Basin District River Basin Management Plan
- Environment Agency Regional DPs
- Water Resources East
- National Policy Statement – Sizewell C
- A14 upgrade
- Cambridge-Milton Keynes-Oxford corridor
- East West Rail

The assessment has used all publicly available information. It should also be noted that the water companies are at different stages of updating their WRMPs and DPs and therefore, further updates may be required to the HRA in-combination at the time of application for any of the drought permits.

3 HRA Screening of Drought Options

3.1 Potential Likely Significant Effects of Drought Options

The HRA of the draft DP22 considered all of AWS drought options. A total of 14 options (supply side and demand side) were screened with seven of these options identified as being within 10km of a European site or where a source receptor pathway beyond 10km could occur. This provided an indication of the schemes that may be likely to have a significant effect on a European site(s). The HRA screening matrix for this assessment is presented in **Table 3.1 – 3.2.**

These screening assessments identified and agreed those designated sites that may be impacted during drought permit implementation, and this is consistent with information used to inform the HRA in DP14 and DP19. Effects in-combination with other drought options within AWS draft DP22 were assessed in the screening process and are documented in the matrix.

The tables show that three out of the seven supply side drought options within AWS draft DP22 are not considered likely to have a significant effect on the qualifying features of European sites. Four of the supply side drought options could lead to LSEs on European designated sites and therefore, were taken through to Stage 2 Appropriate Assessment. Unlike DP19, the DP22 screening assessments concluded no LSEs for River Trent (Hall Water Treatment Works) drought permit, due to negligible impacts on downstream hydrology.

The demand management schemes were not found to have any effects on European sites as they comprise measures which will not result in any new development or water abstraction (repairing leakage and water efficiency measures) and which are largely implemented within urban areas.

Table 3.1 Screening of Supply Side Drought Options for Likely Significant Effects on European Sites.

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
River Colne (Ardleigh Reservoir) drought permit	Colne Estuary SPA (Mid-Essex Coast Phase 2)	Construction There is no construction phase associated with this drought option. Operation The closest abstraction point at East Mills intake is 6.64km north-west of the Colne Estuary SPA via hydrological connectivity. Downstream of the East Mills intake, flows in the River Colne are expected to stay the same as under the existing licence and therefore, negligible effects from this drought option are anticipated. No impact pathways on freshwater flow, water quality, salinity and suspended sediment have been identified and therefore, no likely significant effects (LSE) are anticipated on qualifying features of the SPA.	No	No
	Colne Estuary Ramsar site (Mid-Essex Coast Phase 2)	Construction There is no construction phase associated with this drought option. Operation The closest abstraction point at East Mills intake is 6.64km north-west of the Colne Estuary Ramsar site via hydrological connectivity. Downstream of the East Mills intake, flows in the River Colne are expected to stay the same as under the existing licence and therefore, negligible effects from this drought option are anticipated. No impact pathways on freshwater flow, water quality, salinity and suspended sediment have been identified and therefore, no LSEs are anticipated on qualifying features of the Ramsar site.	No	No
	Essex Estuaries SAC	Construction There is no construction phase associated with this drought option. Operation The closest abstraction point at East Mills intake is 6.64km north-west of the Essex Estuaries SAC via hydrological connectivity. Downstream of the East Mills intake, flows in the River Colne are expected to stay the same as under the existing licence and therefore, negligible effects from this drought option are anticipated. No impact pathways on freshwater flow, water quality, salinity and suspended sediment have been identified and therefore, no LSEs are anticipated on qualifying features of the SAC.	No	No
	Blackwater Estuary SPA (Mid-Essex Coast Phase 4)	Construction There is no construction phase associated with this drought option. Operation The closest abstraction point at East Mills intake is 21.16km north-east of the Blackwater Estuary SPA via hydrological connectivity. Downstream of the East Mills intake, flows in the River Colne are expected to stay the same as under the existing licence and therefore, negligible effects from this drought option are anticipated. No impact pathways on freshwater flow, water quality, salinity and suspended sediment have been identified and therefore, no LSEs are anticipated on qualifying features of the SPA	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
	Blackwater Estuary Ramsar site (Mid-Essex Coast Phase 4)	Construction There is no construction phase associated with this drought option. Operation The closest abstraction point at East Mills intake is 21.16km north-east of the Blackwater Estuary Ramsar site via hydrological connectivity. Downstream of the East Mills intake, flows in the River Colne are expected to stay the same as under the existing licence and therefore, negligible effects from this drought option are anticipated. No impact pathways on freshwater flow, water quality, salinity and suspended sediment have been identified and therefore, no LSEs are anticipated on qualifying features of the Ramsar site.	No	No
River Great Ouse (Offord Intake) drought permit	Portholme SAC	Construction There is no construction phase associated with this drought option. Operation The Offord intake is 4.65km south-west of Portholme SAC. A 50% reduction in minimal residual flow will reduce water flow immediately downstream of the intake along the River Great Ouse. However, this impact is unlikely to affect Portholme SAC due to the presence of Godmanchester lock adjacent to the site, which controls and maintains a constant water level. Fluctuations in abiotic parameters including pH, temperature, suspended sediment and nutrient concentrations may occur due to a reduction in the dilution capacity. However, as the identified impact pathways are limited to periods of low flow when hydrological connectivity between the River Great Ouse and the designated site is negligible, no LSEs on the lowland hay meadows are anticipated.	No	No
	Ouse Washes SAC	Construction There is no construction phase associated with this drought option. Operation The Offord intake is approximately 19.5km south-west of the Ouse Washes SAC and 28.6km via hydrological connectivity. The Ouse Washes SAC is designated for spined loach (*Cobitis taenia*) with a stable population of particular importance present in the counter drain; good water quality and macrophyte abundance noted as factors supporting this population. A 50% reduction in minimal residual flow will reduce water flow immediately downstream of the intake along the River Great Ouse. Abstraction during low flow periods could cause deterioration in water quality including dissolved oxygen, ammonia and orthophosphate (phosphorus should be at or below annual mean of 0.1 mgl^{-1}), salinity and increased siltation on submerged macrophyte communities. Water quality assessments have determined that major impacts are anticipated on orthophosphate concentrations in Reach 2 (Bedford Ouse at Brownshill Staunch to Salters Lode, 35km, SSSI unit 22) during Stage 2 of the drought permit (see Section 4.5 River Great Ouse: Offord Intake (Grafham Water) Environmental Assessment Report (EAR)). Minor impacts on all water quality	Yes	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		determinands are expected as a result off Stage 1 of a drought permit. No impacts on the salinity regime of the River Great Ouse are anticipated as infrastructure downstream of the Offord intake controls the flow rate of freshwater discharged to The Wash Estuary and 'natural' conditions will be maintained. Extended periods of low flow and fluctuations in abiotic conditions could also cause increased algal growth, potentially impacting on the extent of supporting habitat. Therefore, LSEs cannot be ruled out at this stage.		
	Ouse Washes Ramsar site	Construction There is no construction phase associated with this drought option. Operation The Offord intake is approximately 19.5km south-west of the Ouse Washes Ramsar site and 28.6km via hydrological connectivity. The Ouse Washes Ramsar site is designated for the washland, wetland plant and invertebrate assemblages (nationally important) and internationally important bird assemblages/ populations/ species (wintering and breeding). A 50% reduction in minimal residual flow will reduce water flow immediately downstream of the intake along the River Great Ouse. Abstraction during low flow periods could cause deterioration in water quality including dissolved oxygen, ammonia and orthophosphate, salinity and increased siltation on submerged macrophyte communities. Water quality assessments have determined that major impacts are anticipated on orthophosphate concentrations in Reach 2 (Bedford Ouse at Brownshill Staunch to Salters Lode, 35km, SSSI unit 22) during Stage 2 of the drought permit (see Section 4.5 River Great Ouse: Offord Intake (Grafham Water) EAR). No impacts on the salinity regime of the River Great Ouse are anticipated as infrastructure downstream of the Offord intake controls the flow rate of freshwater discharged to The Wash Estuary and 'natural' conditions will be maintained. Minor impacts on all water quality determinands are expected as a result off Stage 1 of a drought permit. Extended periods of low flow and fluctuations in abiotic conditions could cause increased algal growth potentially impacting on the assemblage of wetland plants and extent of supporting habitat for birds and invertebrates. Since the drought permit will only be used during low flow conditions, Offord intake is not anticipated to impact on the frequency or extent of downstream flooding that occurs during high flows. Flooding in the Ouse Washes is also one of the key mechanisms of habitat loss, specifically for breeding and wintering bird populations. Therefore, no terrestrial habitat loss is anticipated as a result of this drought permit. However, LSEs cannot be ruled out for wetland plants, invertebrate assemblages and qualifying bird populations at this stage.	Yes	No
	Ouse Washes SPA	Construction There is no construction phase associated with this drought option. Operation	Yes	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		The Offord intake is approximately 19.5km south-west of the Ouse Washes Ramsar site and 28.6km via hydrological connectivity. The Ouse Washes SPA is designated for nationally important (ruff, *Philomachus pugnax;* gadwall*, Anas strepera;* mallard *A. platyrhynchus,* garganey*, Anas querquedula, n*orthern shoveler*, A. clypeata* and black-tailed godwits; *Limosa limosa*) breeding populations of in summer and internationally/nationally important (Bewick's swan, *Cygnus cohtnrbarius bewictii,* whooper swans, *Cygnus cygnus* and hen harrier *Circus cyaneus)* wintering populations. This includes designation as international important waterbird assemblages, all of which are water dependent. A 50% reduction in minimal residual flow will reduce water flow immediately downstream of the intake along the River Great Ouse. Abstraction during low flow periods could cause deterioration in water quality including dissolved oxygen, ammonia and orthophosphate (phosphorus should be below annual mean of 0.1 mgl^{-1}), salinity and increased siltation on submerged macrophyte communities. Water quality assessments have determined that major impacts are anticipated on orthophosphate concentrations in Reach 2 (Bedford Ouse at Brownshill Staunch to Salters Lode, 35km, SSSI unit 22) during Stage 2 of the drought permit (see Section 4.5 River Great Ouse: Offord Intake (Grafham Water) EAR). No impacts on the salinity regime of the River Great Ouse are anticipated as infrastructure downstream of the Offord intake controls the flow rate of freshwater discharged to The Wash Estuary and 'natural' conditions will be maintained. Minor impacts on all water quality determinands are expected as a result off Stage 1 of a drought permit. Extended periods of low flow and fluctuations in abiotic conditions could cause increased algal growth, potentially impacting on supporting habitat for breeding, feeding and roosting within the River Great Ouse. Therefore, LSEs cannot be ruled out at this stage. Since the drought permit will only be used during low flow conditions, Offord intake is not anticipated to impact on the frequency or extent of downstream flooding that occurs during high flows. Flooding in the Ouse Washes is also one of the key mechanisms of habitat loss, specifically for breeding and wintering bird populations. Therefore, no terrestrial habitat loss is anticipated as a result of this drought permit.		
	The Wash and North Norfolk Coast SAC	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> The Offord intake is approximately 69.1km south-west of the SAC and 98.2km via hydrological connectivity. It is designated for a variety of coastal habitats, harbour seal (*Phoca vitulina*) and European otter (*Lutra lutra*), which are water dependent. A 50% reduction in minimal residual flow will reduce water flow immediately downstream of the intake along the River Great Ouse. Due to the distance between the intake and designated site, changes in the flow regime or physio-chemical status to the extent of the Wash and	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		North Norfolk Coast SAC is not anticipated. Freshwater input in the Ouse estuary is relatively low and minor importance in comparison to estuarine/marine processes. In addition, mean high water springs (the upper tidal limit) is located upstream resulting in considerable mixing of freshwater and saline water prior to reaching the designated site downstream. The impact of freshwater flow reductions will also decrease with distance from the abstraction point due to operational intervention at the Ouse Washes (periodic flushing of freshwater), the operation of Denver Sluice and releases from numerous discharges (which are likely to be greater than naturalised flows, particularly during drought conditions) will minimise the impact of reduced freshwater flows. Therefore, no LSEs are anticipated.		
	The Wash SPA	Construction There is no construction phase associated with this drought option. Operation The Offord intake is located approximately 69.1km south-west of the SPA and 98.2km via hydrological connectivity. It is designated for breeding little terns (*Sterna albifrons*) and common terns (*Cygnus cygnus*) and internationally/ nationally important waterfowl assemblages, which are water dependent. A 50% reduction in minimal residual flow will reduce water flow immediately downstream of the intake along the River Great Ouse. Due to the distance between the intake and designated site, changes in the flow regime or physio-chemical status to the extent of the Wash and North Norfolk Coast SAC is not anticipated. Freshwater input in the Ouse estuary is relatively low and minor importance in comparison to estuarine/marine processes. In addition, mean high water springs (the upper tidal limit) is located upstream resulting in considerable mixing of freshwater and saline water prior to Reaching the designated site downstream. The impact of freshwater flow reductions will also decrease with distance from the abstraction point due to operational intervention at the Ouse Washes (periodic flushing of freshwater), the operation of Denver Sluice and releases from numerous discharges (which are likely to be greater than naturalised flows, particularly during drought conditions) will minimise the impact of reduced freshwater flows. Therefore, no LSEs are anticipated.	No	No
	The Wash Ramsar site	Construction There is no construction phase associated with this drought option. Operation The Offord intake is located approximately 69.1km south-west of the Wash Ramsar site and 98.2km via hydrological connectivity. Qualifying features of the Ramsar site include numerous wintering bird assemblages, wetland invertebrates and harbour seal (*Phoca vitulina*), which are water dependent. A 50% reduction in minimal residual flow will reduce water flow immediately downstream of the intake along the River Great Ouse. Due to the distance between the intake and designated site, changes in the flow regime or physio-	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		chemical status to the extent of the Wash Ramsar site is not anticipated. Freshwater input in the Ouse estuary is relatively low and minor importance in comparison to estuarine/marine processes. In addition, mean high water springs (the upper tidal limit) is located upstream resulting in considerable mixing of freshwater and saline water prior to Reaching the designated site downstream. The impact of freshwater flow reductions will also decrease with distance from the abstraction point due to operational intervention at the Ouse Washes (periodic flushing of freshwater), the operation of Denver Sluice and releases from numerous discharges (which are likely to be greater than naturalised flows, particularly during drought conditions) will minimise the impact of reduced freshwater flows. Therefore, no LSEs are anticipated on the Wash Ramsar site.		
River Nene (Pitsford Reservoir/Duston Mill) drought permit	Upper Nene Gravel Pits SPA	Construction There is no construction phase associated with this drought option. Operation The Pitsford intake is located approximately 5.15 km west of the Upper Nene Gravel Pits SPA and 6.9km downstream via hydrological connectivity. The site is designated for internationally important populations of Eurasian bittern (*Botarius stallaris*), gadwall, golden plover (*Pluvialis apricaria*) and waterbird assemblages, which are all water dependent. Four of the units that make up the Upper Nene Gravel Pits SSSI are in unfavourable – no change condition, four are unfavourable – recovering and one is in favourable condition. The condition of the unfavourable units is due to anthropogenic disturbance and inappropriate scrub control at the site. No in-combination effects with current pressures impacting on the SPA/ SSSI have been identified. Potential indirect impact pathways from the proposed drought permit are reduced water supply to hydrologically connected gravel pits, decreasing the extent of shallow foraging habitat and potential increases in nutrient concentrations with reduced dilution capacity of the associated waterbodies. Any hydrologically connected habitats that are functionally linked to qualifying species of the SPA and also water dependent could also be impacted by reduced water supply. Clifford Hills gravel pits/ Northampton washlands and Earls Barton gravel pits (west) are the closest gravel pits downstream of the abstraction point. Both areas are used favourably for roosting and loafing by golden plover in particular. Water from the River Nene only enters these gravel pits during high or flood flows, with no continuous surface water hydrological connectivity. Therefore, no LSEs are anticipated at these gravel pits. Earls Barton gravel pits (central)/ Summer Leys Local Nature Reserve (LNR) is directly hydrologically connected via surface water to the River Nene. However, as the site is located upstream of the River Nene and the grassland is noted as largely used for foraging by qualifying bird species, negligible impacts from reduced flows downstream are	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		anticipated. In addition, based on elevation maps the River Nene and Earls Barton gravel pits (central)/ Summer Leys LNR are at the same elevation; 45m elevation (5m contours) therefore, it is viewed as unlikely that lower flows in the River Nene will encourage flows from the upstream SPA, downstream. Potential functionally linked habitats that could be impacted by the proposed drought permit include Storton's Pit LNR, which is located on the left bank of the River Nene approximately 200m downstream of the abstraction point. The site includes gravel pits, a fen ditch and an area of wet meadow. Based on WeBS counts from 15/16 – 19/20, gadwall, mute swan and some main component species of the bird assemblages have been recorded at the site. Gadwall has been recorded in the highest numbers with an average 5-year count of 45 individuals[28]. Although some hydrological connectivity is anticipated between the River Nene and Storton's Pit LNR, the main water supply through the site is provided on the northern edge via a storm water outflow[29]. Therefore, no LSEs are anticipated as a result of the drought permit. Another potentially functionally linked habitat that could be impacted by the proposed drought permit is Barnes Meadow LNR. It includes lowland fen priority habitat with a variety of ditches and shallow scrapes and therefore, could support waterbird species. No WeBS counts have been conducted at the site and no qualifying features are mentioned in the site description to suggest that the site forms functionally linked habitat for qualifying bird species. As no changes to baseline groundwater conditions are expected as a result of the drought permit (see Section 4.3.3 of DP22 Nene (Pitsford) EAR), impacts to the Barnes Meadow LNR will be limited to habitats within the immediate vicinity of the River Nene. On the basis that lowland fen priority habitat is approximately 40m from the River Nene main channel, no LSE are anticipated from the drought permit on key habitats that could support qualifying bird species. From unit 4 off the Upper Nene Gravel Pits SSSI onwards (downstream), minor hydrological impacts are anticipated (see Section 4.3 of DP22 Nene (Pitsford) EAR) and therefore, the screening assessment has concluded no LSEs on qualifying bird species and supporting habitat.		

[28] Frost, T.M., Calbrade, N.A., Birtles, G.A., Hall, C., Robinson, A.E., Wotton, S.R., Balmer, D.E. and Austin, G.E. 2021. *Waterbirds in the UK 2019/20: The Wetland Bird Survey*. BTO/RSPB/JNCC. Thetford.
[29] Northampton borough council (2005). Storton's Pits Local Nature Reserve Management Plan 2005 – 2010. Accessed from: http://www.northamptonboroughcouncil.com/documents/s10802/7%20Storton%20Pits%20Mgt%20Plan%2021.08.08.pdf

	Upper Nene Gravel Pits Ramsar site	Construction There is no construction phase associated with this drought option. Operation The Pitsford intake is located approximately 5.15 km west (at its closest point) of the Upper Nene Gravel Pits Ramsar site and 6.9km downstream via hydrological connectivity. The site is designated for wintering waterbird assemblages, wintering mute swan (*Cygnus olor*) and wintering gadwall, which are all water dependent. Four of the units that make up the Upper Nene Gravel Pits SSSI are in unfavourable – no change condition, four are unfavourable – recovering and one is in favourable condition. The condition of the unfavourable units is due to anthropogenic disturbance and inappropriate scrub control at the site. No in-combination effects with current pressures impacting on the Ramsar site/ SSSI have been identified. Potential indirect impact pathways from the proposed drought permit are reduced water supply to hydrologically connected gravel pits, decreasing the extent of shallow foraging habitat and potential increases in nutrient concentrations with reduced dilution capacity of the associated waterbodies. Clifford Hills gravel pits/ Northampton washlands and Earls Barton gravel pits (west) are the closest gravel pits downstream of the abstraction point. Both areas are used favourably for roosting and loafing by golden plover in particular. Water from the River Nene only enters these gravel pits during high or flood flows, with no continuous surface water hydrological connectivity. Therefore, no LSEs are anticipated at these gravel pits. Earls Barton gravel pits (central)/ Summer Leys LNR is directly hydrologically connected via surface water to the River Nene. However, as the site is located upstream of the River Nene and the grassland is noted as largely used for foraging by qualifying bird species, negligible impacts from reduced flows downstream are anticipated. In addition, based on elevation maps the River Nene and Earls Barton gravel pits (central)/ Summer Leys LNR are at the same elevation; 45m elevation (5m contours) therefore, it is viewed as unlikely that lower flows in the River Nene will encourage flows from the upstream Ramsar site, downstream. Potential functionally linked habitats that could be impacted by the proposed drought permit include Storton's Pit LNR, which is located on the left bank of the River Nene approximately 200m downstream of the abstraction point. The site includes gravel pits, a fen ditch and an area of wet meadow. Based on WeBS counts from 15/16 – 19/20, gadwall, mute swan and some main component species of the bird assemblages have been recorded at the site. Gadwall has been recorded in the highest numbers with an average 5 year count of 45 individuals[30]. Although some hydrological connectivity is anticipated between the River Nene and Storton's Pit LNR, the main water supply through the site is provided on the northern edge via a storm water outflow[31]. Therefore, no LSEs are anticipated as a result of the drought permit. Another potentially functionally linked habitat that could be impacted by the proposed drought permit is Barnes Meadow LNR. It includes lowland fen priority habitat with a variety of ditches and shallow scrapes and therefore, could support waterbird species. No WeBS counts have been conducted at the site and no qualifying features are mentioned in the site description to suggest that the site forms functionally linked habitat	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		for qualifying bird species. As no changes to baseline groundwater conditions are expected as a result of the drought permit (see Section 4.3.3 of DP22 Nene (Pitsford) EAR), impacts to the Barnes Meadow LNR will be limited to habitats within the immediate vicinity of the River Nene. On the basis that lowland fen priority habitat is approximately 40m from the River Nene main channel, no LSE are anticipated from the drought permit on key habitats that could support qualifying bird species. From unit 4 off the Upper Nene Gravel Pits SSSI onwards (downstream), minor hydrological impacts are anticipated (see Section 4.3 of DP22 Nene (Pitsford) EAR) and therefore, the screening assessment has concluded no LSEs on qualifying bird species and supporting habitat.		
	Nene Washes SAC	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> The Pitsford/ Duston Mill intake is approximately 61.2km south-west of the Nene Washes SAC and 83.6km via hydrological connectivity. The qualifying feature of the SAC is the spined loach, which is water dependent. Given the distance between the Pitsford intake and the Nene Washes SAC, the localised reduction in flow downstream of the intake is not anticipated to significantly impact on the qualifying species. The hydrological impact assessment for the River Nene (Pitsford Reservoir/Duston Mill) drought permit concluded that negligible impacts during the summer and winter permit are anticipated for Reach 4, which is upstream of the Nene Washes SAC, from Harpers Brook Confluence to the Wansford Abstraction Intake (see Section 4.3 of DP22 Nene (Pitsford) EAR). Additionally, water flows from the River Nene and Moreton's Leam to the Nene Washes are controlled by the Stanground Sluice. Therefore, no impact on water flow and the extent of wetted habitat in the Nene Washes SAC is anticipated and no in-combination effects with the River Nene (Wansford Intake/ Rutland Water) drought permit. There is a potential impact pathway on spined loach due to reduced nutrient dilution capacity downstream, however, inputs from Great Billing water recycling centre (WRC), Broadholme WRC and Flag Fen WRC are expected to increase flows downstream of the abstraction point, as well as inputs from associated tributaries of the River Nene. Therefore, no LSEs are anticipated from this drought option.	No	No

[30] Frost, T.M., Calbrade, N.A., Birtles, G.A., Hall, C., Robinson, A.E., Wotton, S.R., Balmer, D.E. and Austin, G.E. 2021. *Waterbirds in the UK 2019/20: The Wetland Bird Survey*. BTO/RSPB/JNCC. Thetford.
[31] Northampton borough council (2005). Storton's Pits Local Nature Reserve Management Plan 2005 – 2010. Accessed from: http://www.northamptonboroughcouncil.com/documents/s10802/7%20Storton%20Pits%20Mgt%20Plan%2021.08.08.pdf

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
	Nene Washes Ramsar site	Construction There is no construction phase associated with this drought option. Operation The Pitsford/ Duston Mill intake is approximately 61.2km south-west of the Nene Washes Ramsar site and 83.6km via hydrological connectivity. Qualifying features of the Ramsar site include Bewick's swan (wintering), breeding wetland bird, aquatic invertebrate and wetland plant assemblages. This includes plants such as fringe lily *Nymphoides peltata*, hairlike pondweed *Potamogeton trichoides* and marsh dock (*Rumex palustris*) and invertebrates such as aquatic snail *Valvata macrostoma*, the water beetle *Agabus undulatus*, the dragonfly *Libellula fulva* and the hoverfly *Anasimyia interpuncta*. Given the distance between the Pitsford intake and the Nene Washes Ramsar site, the localised reduction in flow downstream of the intake is not anticipated to significantly impact on the qualifying species and habitats. The hydrological impact assessment for the River Nene (Pitsford Reservoir/Duston Mill) drought permit concluded that negligible impacts during the summer and winter permit are anticipated for Reach 4, which is upstream of the Nene Washes SAC, from Harpers Brook Confluence to the Wansford Abstraction Intake (see Section 4.3 of DP22 Nene (Pitsford) EAR). Additionally, water flows from the River Nene and Moreton's Leam to the Nene Washes are controlled by the Stanground Sluice. Therefore, no impact on water flow and the extent of wetted habitat in the Nene Washes Ramsar site is anticipated and no in-combination effects with the River Nene (Wansford Intake/ Rutland Water) drought permit. There is a potential impact pathway due to reduced nutrient dilution capacity downstream, however, inputs from Great Billing WRC, Broadholme WRC and Flag Fen WRC are expected to increase flows downstream of the abstraction point, as well as inputs from associated tributaries of the River Nene. Therefore, no LSEs are anticipated from this drought option.	No	No
	Nene Washes SPA	Construction There is no construction phase associated with this drought option. Operation The Pitsford/Duston Mill intake is approximately 61.2km south-west of the Nene Washes SPA and 83.6km via hydrological connectivity. Qualifying species of the SPA include internationally/nationally important wintering populations of Bewick's swan, wigeon (*Anas penelope*), Eurasian teal (*A. crecca*), gadwall, pintail and northern shoveler, and nationally important summer breeding populations of gadwall, garganey, northern shoveler and black-tailed godwits, which are all water dependent. Given the distance between Duston Mill and the Nene Washes SPA the localised reduction in flow downstream of the intake is not anticipated to significantly impact on the qualifying species. The hydrological impact	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		assessment for the River Nene (Pitsford Reservoir/Duston Mill) drought permit concluded that negligible impacts during the summer and winter permit are anticipated for Reach 4, which is upstream of the Nene Washes SAC, from Harpers Brook Confluence to the Wansford Abstraction Intake. Additionally, water flows from the River Nene and Moreton's Leam to the Nene Washes are controlled by the Stanground Sluice. Therefore, no impact on water flow and the extent of wetted habitat in the Nene Washes SAC is anticipated and no in-combination effects with the River Nene (Wansford Intake/ Rutland Water) drought permit. There is a potential impact pathway due to reduced nutrient dilution capacity downstream, however, inputs from Great Billing WRC, Broadholme WRC and Flag Fen WRC are expected to increase flows downstream of the abstraction point, as well as inputs from associated tributaries of the River Nene. Therefore, no LSEs are anticipated from this drought option.		
	The Wash and North Norfolk Coast SAC	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> The Pitsford/ Duston Mill intake is approximately 102.05km south-west of the Wash and North Norfolk Coast SAC. Qualifying features of the SAC include multiple coastal habitats (sandbanks, mudlfats, coastal lagoons, reefs etc.) and species (European otter and harbour seal), which are all water dependent. Changes to freshwater flows due to the proposed drought permit will minimise with distance downstream from the abstraction points due to structural controls along the watercourse and the input of additional flows from WRC and tributaries. Hydrological and physico-chemical changes in the River Nene as a result of a drought permit at Duston Mill will not extend as far downstream as the Wash. Therefore, no LSEs are anticipated.	No	No
	The Wash SPA	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> The Pitsford/ Duston Mill intake is approximately 102.05km south-west of the Wash and North Norfolk Coast SAC. It is designated for breeding little terns (*Sterna albifrons*) and common terns (*Cygnus cygnus*) and internationally/ nationally important waterfowl assemblages, which are all water dependent. Changes to freshwater flows due to the proposed drought permit will minimise with distance downstream from the abstraction points due to structural controls along the watercourse and the input of additional flows from WRCs and tributaries. Hydrological and physico-chemical changes in the River Nene as a result of a drought permit at Duston Mill will not extend as far downstream as the Wash. Therefore, no LSEs are anticipated.	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
	The Wash Ramsar site	Construction There is no construction phase associated with this drought option. Operation The Pitsford/ Duston Mill intake is approximately 102.05km south-west of the Wash Ramsar site. Qualifying features of the Ramsar site include numerous wintering bird assemblages, wetland invertebrates and harbour seal (*Phoca vitulina*) which are all water dependent. Changes to freshwater flows due to the proposed drought permit will minimise with distance downstream from the abstraction points due to structural controls along the watercourse and the input of additional flows from WRCs and tributaries. Hydrological and physico-chemical changes in the River Nene as a result of a drought permit at Duston Mill will not extend as far downstream as the Wash. Therefore, no likely LSEs are anticipated on the Wash Ramsar site.	No	No
	Rutland Water Ramsar site	Construction There is no construction phase associated with this drought option. Operation The Pitsford/ Duston Mill intake is approximately 48.1km south-west of Rutland Water Ramsar site. Water is abstracted from the River Nene at Wansford, approximately 82km downstream of Duston Mill and discharged into Rutland Reservoir. Therefore, abstraction of water upstream as part of the Pitsford/ Duston Mill drought permit could have an indirect impact on water supply and water quality for Rutland Water. Reduced water flow downstream of Pitsford/ Duston Mill intake could reduce the capacity of abstraction at Wansford therefore, lowering water levels at Rutland Water during times of operation (October – March and April – September). The Ramsar site is designated for wintering gadwall (*Anas strepera*), northern shoveler (*Anas clypeata*) and waterbird assemblages, which are all water dependent. Therefore, the operation of this drought option would overlap with the wintering bird populations present at Rutland Water. This could reduce wetted areas available in Rutland Water impacting on macrophyte and aquatic invertebrate communities at the periphery of the reservoir. However, due to high rainfall associated with autumn and winter no LSE on water levels are anticipated. In addition, Rutland Water is also supplied water via WRCs and tributaries between Pitsford/ Duston Mill and Wansford under drought permit conditions. Hydrological assessments of the Pitsford/ Duston Mill intake have confirmed that there will be negligible hydrological impacts during summer and winter in Reach 4 of the River Nene. Therefore, no in-combination impacts with Wansford/ Rutland intake are anticipated. There is also potential for the Pitsford/ Duston Mill intake to reduce water quality, particularly via an increase in phosphate concentrations. However, due to the distance (82km), number of tributaries between Pitsford/ Duston Mill and Wansford that will continue diluting nutrient concentrations, no LSEs on the Ramsar site	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		are anticipated. The hydrological assessment also supports that there will be negligible hydrological impacts in Reach 4 of the River Nene.		
	Rutland Water SPA	Construction There is no construction phase associated with this drought option. Operation The Pitsford/ Duston Mill intake is approximately 48.1km south-west of Rutland Water SPA. Water is abstracted from the River Nene at Wansford, approximately 82km downstream of Duston Mill and discharged into Rutland Reservoir. Therefore, abstraction of water upstream as part of the Pitsford/ Duston Mill drought permit could have an indirect impact on water supply and water quality for Rutland Water. Reduced water flow downstream of Pitsford/ Duston Mill intake could reduce the capacity of abstraction at Wansford therefore, lowering water levels at Rutland Water during times of operation (October – March and April – September). The SPA is designated for a number of non-breeding bird species, which are all water dependent. Therefore, the operation of this drought option would overlap with non-breeding waterbird assemblages present at Rutland Water. This could reduce wetted areas available at Rutland Water impacting on macrophyte and aquatic invertebrate communities at the periphery of the reservoir. However, due to high rainfall associated with autumn and winter, no LSE on water levels are anticipated. In addition, Rutland Water is also supplied water via WRCs and tributaries between Pitsford/ Duston Mill and Wansford under drought permit conditions. Hydrological assessments of the Pitsford/ Duston Mill intake have confirmed that there will be negligible hydrological impacts during summer and winter in Reach 4 of the River Nene. Therefore, no in-combination impacts with Wansford/ Rutland intake are anticipated. There is also potential for the Pitsford/ Duston Mill intake to reduce water quality; particularly via an increase in phosphate concentrations. However, due to the distance (82km), number of tributaries between Pitsford/ Duston Mill and Wansford that will continue diluting nutrient concentrations, no LSEs on the Ramsar site are anticipated. The hydrological assessment also supports that there will be negligible hydrological impacts in Reach 4 of the River Nene.	No	No
River Nene (Wansford Intake/ Rutland Water) drought permit	Nene Washes SAC	Construction There is no construction phase associated with this drought option. Operation The Rutland/ Wansford intake is approximately 11.95km west of the Nene Washes SAC and 16.82km downstream via hydrological connectivity. The qualifying feature of the SAC is the spined loach (*Cobitis taenia*), which is water dependent. Potential impact pathways on the Nene Washes SAC include reduced water flow during operation from December - April and May - November and deterioration in water quality (particularly nutrient concentrations, biochemical oxygen demand and salinity) and increased siltation. As water	Yes	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		levels in the Nene Washes are maintained by inundation and controlled via a Water Level Management Plan, reduced water flow downstream of Rutland/ Wansford intake is unlikely to impact on water levels in the Nene washes. Operation of this drought option could result in deteriorations in water quality, due to a reduction in dilution capacity of nutrient concentrations (particularly orthophosphate) and pollutant inputs into the watercourse and an increase in siltation. This could impact on sensitive wetland habitat associated with the Nene Washes. During autumn and winter operation of Rutland/ Wansford intake, the Stanground Sluice is kept open by 6 inches in order to provide a freshening flow and maintain the water levels for designated sites until the growing season begins again. During proposed operation in spring and summer, the Stanground Sluice is kept open and the Nene Washes will be fully exposed to any changes in water quality, increased siltation and reduced water flow. This could impact on the structure and function of the habitat; particularly macrophyte communities which support the spined loach. Therefore, LSEs cannot be ruled out at this stage.		
	Nene Washes Ramsar site	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> The Rutland intake is approximately 11.95km west of the Nene Washes Ramsar site and 16.82km downstream via hydrological connectivity. Qualifying features of the Ramsar site include Bewick's swan (wintering), breeding wetland bird assemblages, invertebrate assemblages and plant assemblages. Potential impact pathways on the Nene Washes Ramsar site include reduced water flow during operation from December - April and May - November and deterioration in water quality (particularly nutrient concentrations, biochemical oxygen demand and salinity) and an increase in siltation. As water levels in the Nene Washes are maintained by inundation and controlled via a Water Level Management Plan, reduced water flow downstream of Rutland/ Wansford intake is unlikely to impact on water levels in the Nene washes. Operation of this drought option could result in deteriorations in water quality via increased concentrations of orthophosphate in the water course; which could impact on sensitive wetland habitat associated with the Nene Washes. During autumn and winter operation of Rutland/ Wansford intake, Stanground Sluice kept open by 6 inches in order to provide a freshening flow and maintain the water levels for designated sites until the growing season begins again. During proposed operation in spring and summer, the Stanground Sluice is kept open and the Nene Washes will be fully exposed to any changes in water quality, increased siltation and reduced water flow. This could impact on the structure and function of supporting habitat (macrophytes) and breeding bird assemblages. Therefore, LSEs cannot be ruled out at this stage.	Yes	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
	Nene Washes SPA	Construction There is no construction phase associated with this drought option. Operation The Rutland intake is approximately 11.95km west of the Nene Washes SPA and 16.82km downstream via hydrological connectivity. Qualifying species of the SPA include internationally/nationally important wintering populations of Bewick's swan, wigeon (*Anas penelope*), Eurasian teal (*A. crecca*), gadwall, pintail and northern shoveler, and nationally important summer breeding populations of gadwall, garganey, northern shoveler and black-tailed godwits, which are water dependent. Potential impact pathways on the Nene Washes SPA include reduced water flow during operation from December - April and May – November, deterioration in water quality (particularly nutrient concentrations, biochemical oxygen demand and salinity) and an increase in siltation. As water levels in the Nene Washes are maintained by inundation and controlled via a Water Level Management Plan, reduced water flow downstream of Rutland/ Wansford intake is unlikely to impact on water levels in the Nene washes. Operation of this drought option could result in deteriorations in water quality via increased concentrations of orthophosphate in the water course; which could impact on sensitive wetland habitat associated with the Nene Washes. During autumn and winter operation of Rutland/ Wansford intake, Stanground Sluice is kept open by 6 inches in order to provide a freshening flow and maintain the water levels for designated sites until the growing season begins again. During proposed operation in spring and summer, the Stanground Sluice is kept open and the Nene Washes will be exposed to any changes in water quality, increased siltation and reduced water flow. This could impact on the structure and function of supporting habitat (macrophytes) and particularly breeding bird assemblages. Water quality data in Moreton's Leam is marginally within acceptable limits at present. Therefore, LSEs cannot be ruled out at this stage.	Yes	No
	The Wash and North Norfolk Coast SAC	Construction There is no construction phase associated with this drought option. Operation The Wash and North Norfolk Coast SAC is approximately 49.05km north-east of the Rutland/ Wansford intake and 63.1km via hydrological connectivity. Qualifying features of the SAC include multiple coastal habitats (sandbanks, mudlfats, coastal lagoons, reefs etc.) and species (European otter and harbour seal), which are water dependent. Changes to freshwater flows due to the proposed drought permit will minimise with distance downstream from the abstraction points due to structural controls along the watercourse and the input of additional flows from tributaries. Hydrological and physico-chemical changes in the River Nene as a result of a drought permit at Rutland/ Wansford intake will	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		not extend as far downstream as the The Wash. Therefore, no LSEs are anticipated on the Wash and North Norfolk Coast SAC.		
	The Wash Ramsar site	Construction There is no construction phase associated with this drought option. Operation The Wash Ramsar site is approximately 49.05km north-east of the Rutland/ Wansford intake and 63.1km via hydrological connectivity. Qualifying features of the Ramsar site include numerous wintering bird assemblages, wetland invertebrates and harbour seal (*Phoca vitulina*). Changes to freshwater flows due to the proposed drought permit will minimise with distance downstream from the abstraction points due to structural controls along the watercourse and the input of additional flows from tributaries. Hydrological and physico-chemical changes in the River Nene as a result of a drought permit at Rutland/ Wansford intake will not extend as far downstream as the Wash. Therefore, no LSEs are anticipated on the Wash Ramsar site.	No	No
	The Wash SPA	Construction There is no construction phase associated with this drought option. Operation The Wash SPA is approximately 49.05km north-east of the Rutland/ Wansford intake and 63.1km via hydrological connectivity. It is designated for breeding little terns (*Sterna albifrons*) and common terns (*Cygnus cygnus*) and internationally/ nationally important waterfowl assemblages, which are water dependent. Changes to freshwater flows due to the proposed drought permit will minimise with distance downstream from the abstraction points due to structural controls along the watercourse and the input of additional flows from tributaries. Hydrological and physico-chemical changes in the River Nene as a result of a drought permit at Rutland/ Wansford intake will not extend as far downstream as the Wash. Therefore, no LSEs are anticipated on the Wash Ramsar site.	No	No
	Rutland Water Ramsar site	Construction There is no construction phase associated with this drought option. Operation Rutland Water Ramsar site is located approximately 15.67km north-west of the Rutland/ Wansford intake and the drought option will replenish water in Rutland Water; therefore, they are hydrologically connected via a pipeline. The drought option involves increased refilling of Rutland Water through a 50% reduction in the MRF from 125 Ml/d for December to April and 150 Ml/d for May to November to 62.5 Ml/d for December to April and 75 Ml/d for May to November. The Ramsar site is designated for gadwall, northern shoveler and an assemblage of >20,000 non-breeding/ wintering waterbirds. Rutland Water SSSI that	Yes	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		overlaps in extent with the Ramsar site is currently in favourable condition across all units (029, 030 and 031). The operation of this proposed drought option would overlap with the timeframe that qualifying bird species of Rutland Water are present at the site. The following indirect impact pathways have been identified from the operation of the proposed drought option: an increase in water depth and therefore, potential reduction in extent of shallow foraging habitat and deterioration in water quality, which could impact on macrophyte community assemblage and extent. The optimal depth for gadwall to forage in open water is <0.25m and for northern shoveler is 0.3m. As water levels in Rutland Water are controlled, it is anticipated that shallow foraging habitats will be maintained to continue supporting qualifying species of the Ramsar site. Hydrological assessments of the Pitsford/ Duston Mill intake have confirmed that there will be negligible hydrological impacts during summer and winter in Reach 4 of the River Nene. Therefore, no in-combination impacts with Wansford/ Rutland intake are anticipated (see Section 4.3 of DP22 Nene (Pitsford) EAR). In 2019, phosphate concentrations in the River Nene at Islip to tidal (GB105032050381) were classified as poor[32]. Under drought conditions, it is anticipated that nutrient concentrations (phosphate in particular) of the abstracted water will be high. Based on water quality data collected at Hambleton South Shore, Rutland Water in 2019 – 2020, total phosphorus concentrations were above the WFD EQS threshold for moderate alkalinity, deep waterbodies (mean phosphorus of 0.082 mg/l, annual mean threshold is 0.012 mg/l). Although it is anticipated that excess orthophosphate will be assimilated by perennial macrophytes in the system (eg. *Potamogeton* species), there is uncertainty whether discharged water into Rutland Water will be within the specific WFD good EQS thresholds for moderate alkalinity, deep waterbodies. Elevated nutrient concentrations (particularly phosphate and nitrates) could lead to significant blue-green algal blooms and negative impacts on food availability if macrophyte community assemblages are altered. This is a known pressure on the system, in lagoons 2 and 3. On that basis, there is potential for LSEs on qualifying species of the Ramsar site without consideration of mitigation measures such as pre-treatment prior to discharge into Rutland Water.		
	Rutland Water SPA	<u>Construction</u> There is no construction phase associated with this drought option.	Yes	No

[32] Environment Agency (2019). Nene – Islip to tidal. Catchment Data Explorer. Accessed from: Environment Agency - CDE - Nene - Islip to tidal (data.gov.uk)

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		<u>Operation</u> Rutland Water SPA is located approximately 15.67km north-west of the Rutland/ Wansford intake and the drought option will replenish water in Rutland water; therefore, they are hydrologically connected via a pipeline. The drought option involves increased refilling of Rutland Water through a 50% reduction in the MRF from 125 Ml/d for December to April and 150 Ml/d for May to November to 62.5 Ml/d for December to April and 75 Ml/d for May to November. The SPA is designated for gadwall, northern shoveler and an assemblage of >20,000 non-breeding/ wintering waterbirds. Rutland Water SSSI that overlaps in extent with the SPA is currently in favourable condition across all units (029, 030 and 031). The operation of this proposed drought option would overlap with the timeframe that qualifying bird species of Rutland Water are present at the site. The following indirect impact pathways have been identified from the operation of the proposed drought option: an increase in water depth and therefore, potential reduction in extent of shallow foraging habitat and deterioration in water quality, which could impact on macrophyte community assemblage and extent. The optimal depth for gadwall to forage in open water is <0.25m and for northern shoveler is 0.3m. As water levels in Rutland Water are controlled (consult with Wildlife Trust), it is anticipated that shallow foraging habitats will be maintained to continue supporting qualifying species of the SPA. Hydrological assessments of the Pitsford/ Duston Mill intake have confirmed that there will be negligible hydrological impacts during summer and winter in Reach 4 of the River Nene. Therefore, no in-combination impacts with Wansford/ Rutland intake are anticipated (see Section 4.3 of DP22 Nene (Pitsford) EAR). In 2019, phosphate concentrations in the River Nene at Islip to tidal (GB105032050381) were classified as poor[33]. Under drought conditions, it is anticipated that nutrient concentrations (phosphate in particular) of the abstracted water will be high. In supplementary advice for Rutland Water SPA, it suggests that meeting the surface water environmental standards set out by the WFD will be sufficient to support the SPA Conservation Objectives. Based on water quality data collected at Hambleton South Shore, Rutland Water in 2019 – 2020, total phosphorus concentrations were above the WFD EQS threshold for moderate alkalinity, deep waterbodies (mean phosphorus of 0.082 mg/l, annual mean threshold is 0.012 mg/l). Although it is anticipated that excess orthophosphate will be assimilated by perennial macrophytes in the system (eg. *Potamogeton* species),		

[33] Environment Agency (2019). Nene – Islip to tidal. Catchment Data Explorer. Accessed from: Environment Agency - CDE - Nene - Islip to tidal (data.gov.uk)

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		there is uncertainty whether discharged water into Rutland Water will be within the specific WFD good EQS thresholds for moderate alkalinity, deep waterbodies. Elevated nutrient concentrations (particularly phosphate and nitrates) could lead to significant blue-green algal blooms and negative impacts on food availability if macrophyte community assemblages are altered. This is a known pressure on the system, in lagoons 2 and 3. On that basis, there is potential for LSEs on qualifying species of the SPA without consideration of mitigation measures such as pre-treatment prior to discharge into Rutland Water.		
River Trent (Hall Water Treatment Works) drought permit	Humber Estuary SAC	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> This drought option includes the temporary reduction in the hands-off flow (HoF) to 1,450Ml/d during periods of low flow. This will allow abstraction to continue in conditions below the current minimum permissible flow. The Hall (Newton) intake is located approximately 36.4km south of the Humber Estuary SAC and 52km via hydrological connectivity. The SAC is designated for a number of coastal habitats including sandbanks, mudflats, Atlantic salt meadows and shifting dunes plus for sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and grey seal (*Halichoerus grypus*), which are water dependent. Potential impact pathways on the qualifying features during operation include reductions in water flow impeding upstream migration to spawning grounds, changes in salinity regime, suspended sediment and nutrient concentrations. A hydrological assessment has been undertaken from North Muskham gauging station to the Humber Estuary, referred to as Reach 1. Under drought permit conditions, there is a reduction of 3.8% in the summer Q_{99} flow statistics for both the start of Reach 1 and abstraction point. The reduction in flow would be 4.4% at the reduced HoF threshold of 1,450 Ml/d. There is no reduction in flows for the summer Q_{95}, annual Q_{95} and annual $Q_{50,}$ as these flow values are well above the existing HoF and do not constrain abstraction in baseline conditions. This is assessed as a negligible hydrological impact during both summer and winter drought permit conditions for the start of Reach 1 and downstream of the abstraction point (see Section 4.3 of DP22 Trent Environmental Assessment Report (EAR)). In addition, negligible impacts to water quality are anticipated when considering potential changes in total ammonia, dissolved oxygen saturation and orthophosphate concentrations (See Section 4.5 of DP22 Trent EAR) and geomorphology (see Section 4.4 of DP22 Trent EAR).	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		Cromwell weir is present upstream of the proposed abstraction point. There is a risk that reductions in water flow downstream could limit the ability of river lamprey and sea lamprey to navigate the weir. However, based on evidence presented in the Supplementary Advice on Conservation Objectives for the Humber Estuary SAC, Cromwell weir is currently 'considered as impassable' for river lamprey and sea lamprey. Therefore, it is not anticipated that the implementation of the drought permit and associated reduced flows downstream will impact on the passage of lamprey species passed Cromwell weir as it is currently impassable. Considering all available evidence, no LSE are anticipated on the qualifying features of the Humber Estuary SAC.		
	Humber Estuary SPA	Construction There is no construction phase associated with this drought option. Operation This drought option includes the temporary reduction in the HoF to 1,450Ml/d during periods of low flow. This will allow abstraction to continue in conditions below the current minimum permissible flow. The Hall (Newton) intake is located approximately 36.4km south of the Humber Estuary SPA and 52km via hydrological connectivity. The SPA is designated for a number of non-breeding bird species including waders, waterfowl and birds of prey, which are water dependent. Potential impact pathways on the qualifying features during operation include changes in the extent of suitable foraging and roosting habitat due to lower water flows, changes in salinity regime, suspended sediment and nutrient concentrations. These changes could impact on supporting habitats of associated bird assemblages including mudflats and Atlantic saltmarsh. These temporary changes in hydrology and physio-chemical parameters are anticipated to have negligible impact from North Muskham gauging station to the Humber Estuary, referred to as Reach 1 (see Section 4.3, 4.4 and 4.5 of DP22 Trent EAR). Therefore, no impact pathways have been identified that could impact on functionally linked habitat. No LSEs are anticipated on the qualifying bird species of the Humber Estuary SPA.	No	No
	Humber Estuary Ramsar Site	Construction There is no construction phase associated with this drought option. Operation This drought option includes the temporary reduction in the HoF to 1,450Ml/d during periods of low flow. This will allow abstraction to continue in conditions below the current minimum permissible flow. The Hall (Newton) intake is located approximately 36.4km south of the Humber Estuary Ramsar site and 52km via hydrological connectivity. The Ramsar site is designated for a number of wintering and passage bird species, river and sea lamprey, grey seal (*Halichoerus grypus*), Natterjack toad (*Epidalea calamita*) and the estuary habitat, which are water dependent. Potential impact pathways on the qualifying features during	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		operation include reductions in water flow that could impede upstream migration of lamprey species to suitable spawning grounds, changes in the availability of foraging and roosting habitat, changes in salinity regime, suspended sediment and nutrient concentrations. These changes could impact on supporting habitats of associated bird assemblages including mudflats and Atlantic saltmarsh and the wetted width of the River Trent for lamprey and Natterjack toad. Hydrological, water quality and geomorphology impact assessments have concluded that there would be negligible impacts from the proposed drought permit from North Muskham gauging station to the Humber Estuary, referred to as Reach 1 (see Section 4.3, 4.4 and 4.5 of DP22 Trent EAR). Therefore, no impact pathways have been identified that could impact on functionally linked habitat for qualifying birds and Natterjack toad. Cromwell weir is present upstream of the proposed abstraction point. There is a risk that reductions in water flow downstream could limit the ability of river lamprey and sea lamprey to navigate the weir. However, based on evidence presented in the Supplementary Advice on Conservation Objectives for the Humber Estuary SAC, Cromwell weir is currently 'considered as impassable' for river lamprey and sea lamprey. Therefore, it is not anticipated that the implementation of the drought permit and associated reduced flows downstream will impact on the passage of lamprey species passed Cromwell weir as it is currently impassable. Considering all available evidence, no LSE are anticipated on the qualifying features of the Humber Estuary Ramsar site.		
River Wensum (Costessey groundwater sources) drought permit	River Wensum SAC	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> The River Wensum SAC is approximately 0.12km north-east of the Costessey groundwater sources. Qualifying features of the SAC include Desmoulin's whorl snail (*Vertigo moulinsiana*), white-clawed crayfish (*Austropotamobius pallipes*), brook lamprey (*Lampetra planeri*), bullhead (*Cottus gobio*) and the water courses with floating vegetation dominated by water-crowfoot (*Ranunculion fluitantis*), which are all water dependent. This drought option includes the temporary increase in the maximum annual licensed abstraction rate from the groundwater sources, when flows in the River Wensum are low from 2000 Ml/yr to 4800 Ml/yr. Potential impact pathways include reduced flow rates in the River Wensum, reduced groundwater refilling rates, water quality deterioration and increased siltation. Hydrological impact assessments of the River Wensum have concluded that during annual Q_{99} in Reach 1 (Morton to Costessey intake, 5.6km, SSSI units 53 and 54) the drought	Yes (Brook lamprey, bullhead, Desmoulin's whorl snail and Annex 1 habitat)	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		permit will result in a 5.2% reduction in river flow, in comparison to naturalised flows. In Reach 2 (Costessey intake to River Tud confluence, 11km, SSSI unit 54), during annual Q_{99} the drought permit will result in a 9.1% reduction in river flow, in comparison to naturalised flows. In Reach 3 (River Tud confluence to River Yare confluence, 14.1km, SSSI unit 54), during annual Q_{99} the drought permit will result in a 11% reduction in river flow, in comparison to naturalised flows. The anticipated impacts on the flow regime of Reach 1 and 2 are compliant with the water course qualifying feature flow attribute targets within the Conservation Objectives; this is based on the low flows (Q_{99}) limit of 10% deviation from naturalised flows. However, the flow regime in Reach 3 is anticipated to exceed the 10% threshold during annual Q_{99} and therefore, the drought permit would not be compliant with the Conservation Objectives of the designated site. However, an additional drawdown of 4 – 5m in comparison to baseline groundwater levels is anticipated considering the worst-case scenario, during operation of the drought permit. Water level monitoring has found that the groundwater levels in the adjacent land parcels are strongly correlated with levels in the River Wensum, indicating a direct hydrological link between the groundwater levels and river levels. This could impact on the availability of wetted habitat required for Desmoulin's whorl snail, with SSSI units 38 and 39 exposed to an estimated additional drawdown of 2 – 3m (see Section 4.3.1 of the River Wensum (Costessey Boreholes) Drought Permit EAR). Key abiotic parameters that could impact on qualifying features of the SAC are phosphate concentrations and dissolved oxygen saturation. The annual average orthophosphate concentrations at Taverham Bridge monitoring station (2010 – 2020) was 0.07 mg/l. Although this is within the WFD 'Good' Environmental Quality Standards (EQS) threshold, the site is currently above the target of 0.03 mg/l by 2027 (interim goal of 0.05 mg/l by 2021) for the nutrients attribute. With the implementation of the drought permit and anticipated minor changes in flow regime (in Reach 3), it is likely that nutrient concentrations during operation will increase in the River Wensum and further exceed the target for soluble reactive phosphorus. Water quality assessments have determined that orthophosphate concentrations are likely to increase in Reach 2 during the summer and Reach 3 throughout the year (see Section 4.5 of River Wensum (Costessey Boreholes) Drought Permit EAR). This could impact on all of the qualifying features of the SAC and associated supporting habitat. Dissolved oxygen saturation in the River Wensum at Taverham Bridge monitoring station (2010 – 2020) was 81.48 (10%ile) which is within favourable conditions for white clawed crayfish, which require >70% oxygen saturation. However, dissolved oxygen saturation remains slightly below the attribute target of 85% saturation for the water course with		

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		floating vegetation dominated by water-crowfoot. Negligible impacts to dissolved oxygen saturation is anticipated across Reach 1, 2 and 3 based on the water quality assessment (noted that WFD 'Good' EQS values are used). Minor reductions in flow regime in Reach 3 may result in an increase in the deposition of sediment within the channel (see Section 4.4 of River Wensum (Costessey Boreholes) Drought Permit EAR), which could impact on the removal of excess sediment which is required for Ranunculaceae species in autumn, to allow growth in the summer and the suitability of spawning gravels. However, as changes in flow regime will remain within the low – moderate flows (Q_{95} – Q_{50}) limit of 15% deviation from baseline ('natural' flows), no LSEs are anticipated. In conclusion, LSEs on qualifying features of the SAC cannot be ruled out at this stage, on the basis of water quality deterioration and reduction in groundwater levels during operation of the proposed drought permit.		
Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit	Breckland SPA	Construction There is no construction phase associated with this drought option. Operation Wellington Wellfield boreholes are located in the Breckland SPA. The drought option is to increase the daily licensed flow by 10 Ml/d to support Stoke Ferry water treatment works. The increase will be divided between Wellington Wellfield and Denton Lodge borehole and will be used during drought conditions. The qualifying species of the SPA are breeding nightjar (*Caprimulgus europaeus*), stone curlew (*Burhinus oedicnemus*) and woodlark (*Lullula arborea*), which are all water dependent. A potential impact pathway during operation (overlapping with the breeding season) is habitat loss, if supporting habitats of the qualifying bird species were groundwater dependent. Supporting habitat for nightjar, stone curlew and woodlark include grass heath and conifer plantations which are not classified as groundwater dependent. Therefore, no mechanisms for habitat loss have been identified and no LSEs are anticipated.	No	No
	Breckland SAC	Construction There is no construction phase associated with this drought option. Operation The closest Wellington Wellfield borehole to the Breckland SAC is approximately 1.16km north-east of the SAC. The drought option is to increase the daily licensed flow by 10Ml/d to support Stoke Ferry water treatment works. The increase will be divided between Wellington Wellfield and Denton Lodge borehole and will be used during drought conditions. Qualifying features of the SAC include inland dunes, natural eutrophic lakes, European dry heaths, semi-natural dry grasslands and scrubland, alluvial woods with	Yes	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		common alder (*Alnus glutinosa*) and ash (*Fraxinus excelsior*), and great crested newts (*Triturus cristatus*). All of the qualifying features apart from semi-natural dry grasslands and scrubland are water dependent. However, natural eutrophic lakes, alluvial woods and great crested newts are of concern, as they are reliant on groundwater supply. The SAC is located on a highly productive, fractured chalk aquifer and therefore, is hydrologically connected with the proposed option. The closest area of the SAC with groundwater dependent qualifying features is associated with the Stanford Training Area SSSI, 6.4km east of the borehole sites. Other areas of the SAC consist of calcareous grassland, acid grassland, heathland and arable land which are reliant on surface water supply. Modelling has shown that baseline groundwater level depths range between 1.69 - 24.5m (summer) and 0.98 - 23.3m (winter) (see Section 4.3.1 in DP22 Wellington Wellfield EAR). The minimum groundwater levels may decrease by 0.26m in summer and 0.22m in winter. Impacts during the summer can be screened out as the groundwater is not high enough where abstraction will cause Groundwater Dependent Terrestrial Ecosystem's (GWDTE's) conditions to decrease, therefore, impacts in summer are negligible. Given that the ground water levels in winter are already fairly low for GWDTE's (0.98m) and the abstractions may reduce this by a further 0.22m, this may result in the lakes being unable to replenish and a reduction in available habitat for macrophyte communities and great crested newts. The reduction in water may result in the influx of opportunistic terrestrial grass species as the site may undergo succession should recharge rates not be sufficient. Waterbodies present within the Breckland SAC are known to occasionally dry out, however, the abstractions may exacerbate and extend the dry period experienced within the site. Therefore, impacts on groundwater levels are assessed as moderate in winter. On that basis, LSE cannot be ruled out at this stage due to groundwater supply reductions during the winter period and the potential impact on groundwater dependent qualifying features of the Breckland SAC.		
	Norfolk Valley Fens SAC	<u>Construction</u> There is no construction phase associated with this drought option. <u>Operation</u> The closest Wellington Wellfield borehole to the Norfolk Valley Fens SAC is approximately 6.59km south of the SAC. The drought option is to increase the daily licensed flow by 10Ml/d to support Stoke Ferry water treatment works. Qualifying features of the SAC include Northern Atlantic wet heaths, European dry heaths, semi-natural dry grasslands and scrubland, *Molinia* meadows, calcareous and alkaline fens, alluvial woods, Desmoulins whorl snail (*Vertigo moulinsiana*) and narrow-mouthed snail (*Vertigo angustior*). Potential impact pathways from the proposed drought option include changes to river and	No	No

Option	European site	Potential for effects on qualifying features?	Is the option likely to have a significant effect on European site(s) alone?	Effect in-combination with other Anglian Water drought permits?
		groundwater levels, water flow regimes in local river systems, surface flooding, water quality and entrapment. Modelling has shown that baseline groundwater level depths range between 1.26-4.46m (summer) and 0.97-3.72m (winter). Modelling has shown that minimum groundwater levels may decrease by 0.04m in summer and 0.04m in winter (see Section 4.3.1 in DP22 Wellington Wellfield EAR). Impacts during the summer can be screened out as the groundwater is not high enough where abstraction will cause GWDTE's conditions to decrease, therefore, impacts in summer are negligible. Given that the ground water levels in winter are already fairly low for GWDTE's (0.97m) and the abstractions may reduce this by a further 0.04m, this is unlikely to cause long term impacts within the site and the qualifying features, therefore, impacts are assessed as minor in winter. On this basis, no LSEs on qualifying features of the Norfolk Valley Fens SAC are anticipated.		

*See hydrological impact assessment reports by Ricardo (2021) for details regarding the zone of influence of each drought option.

Table 3.2 Screening of Demand Side Drought Options for Likely Significant Effects on European Sites.

Option	Likely Significant Effect?	Further HRA Assessment Required?
Customer metering	Customer metering is a demand management measure which is not anticipated to cause Likely Significant Effects (LSEs) on European designated sites.	No
Targeted leakage reduction	It is envisaged that leakage detection and reduction via repair schemes will largely be undertaken in urban areas. No LSE on designated sites are anticipated.	No
Communication campaigns and messaging	Communication campaigns and messaging will include increased water efficiency messages. No LSEs on designated sites are anticipated.	No
Water efficiency activities	Water efficiency activities are demand management measures and as such, are not anticipated to have LSEs on European designated sites.	No
Temporary Use Bans	Temporary use bands are demand management measures and as such, are not anticipated to have LSEs on European designated sites.	No
Non-Essential Use Bans	Non-essential use bans are demand management measures and as such, are not anticipated to have LSEs on European sites.	No
Emergency drought orders (rota cuts)	In a very extreme drought, AWS may also have to consider employing severe restrictions such as rota cuts, implemented through emergency drought orders. AWS do not consider standpipes to be a practicable option. Rota cuts are demand management measures and as such, are not anticipated to have LSEs on European sites.	No

3.2 HRA Stage 1 Screening conclusions

A summary of the outcomes of the HRA Stage 1 Screening assessment for the supply side drought permit options in AWS draft DP22 is presented below in **Table 3.3.** The demand side drought options, extreme supply side options and extreme demand side options have been excluded as no Likely Significant Effects anticipated.

Table 3.3: Summary of the outcomes of HRA Stage 1 Screening Assessment of the supply side drought permit options in AWS's draft DP22, indicating which require Stage 2 Appropriate Assessment due to potential likely significant effects on European designated sites.

European designated site	Drought Option	Likely Significant Effect?
Colne Estuary SPA (Mid-Essex Coast Phase 2)	River Colne (Ardleigh Reservoir) drought permit	No
Colne Estuary Ramsar site (Mid-Essex Coast Phase 2)	River Colne (Ardleigh Reservoir) drought permit	No
Essex Estuaries SAC	River Colne (Ardleigh Reservoir) drought permit	No
Blackwater Estuary SPA (Mid-Essex Coast Phase 4)	River Colne (Ardleigh Reservoir) drought permit	No
Blackwater Estuary Ramsar site (Mid-Essex Coast Phase 4)	River Colne (Ardleigh Reservoir) drought permit	No
Portholme SAC	River Great Ouse (Offord Intake) drought permit	No
Ouse Washes SAC	River Great Ouse (Offord Intake) drought permit	Yes
Ouse Washes Ramsar site	River Great Ouse (Offord Intake) drought permit	Yes
Ouse Washes SPA	River Great Ouse (Offord Intake) drought permit	Yes
The Wash and North Norfolk Coast SAC	River Great Ouse (Offord Intake) drought permit	No
	River Nene (Pitsford Reservoir/Duston Mill) drought permit	No
	River Nene (Wansford Intake/ Rutland Water) drought permit	No
The Wash SPA	River Great Ouse (Offord Intake) drought permit	No
	River Nene (Pitsford Reservoir/Duston Mill) drought permit	No
	River Nene (Wansford Intake/ Rutland Water) drought permit	No
The Wash Ramsar site	River Great Ouse (Offord Intake) drought permit	No
	River Nene (Pitsford Reservoir/Duston Mill) drought permit	No
	River Nene (Wansford Intake/ Rutland Water) drought permit	No
Upper Nene Gravel Pits SPA	River Nene (Pitsford Reservoir/Duston Mill) drought permit	No
Upper Nene Gravel Pits Ramsar site	River Nene (Pitsford Reservoir/Duston Mill) drought permit	No
Nene Washes SAC	River Nene (Pitsford Reservoir/Duston Mill) drought permit	No
	River Nene (Wansford Intake/ Rutland Water) drought permit	Yes
Nene Washes Ramsar site	Pitsford Reservoir/Duston Mill	No
	River Nene (Wansford Intake/ Rutland Water) drought permit	Yes
Nene Washes SPA	Pitsford Reservoir/Duston Mill	No
	River Nene (Wansford Intake/ Rutland Water) drought permit	Yes
Rutland Water Ramsar site	Pitsford Reservoir/Duston Mill	No

European designated site	Drought Option	Likely Significant Effect?
	River Nene (Wansford Intake/ Rutland Water) drought permit	Yes
Rutland Water SPA	Pitsford Reservoir/Duston Mill	No
	River Nene (Wansford Intake/ Rutland Water) drought permit	Yes
Humber Estuary SAC	River Trent (Hall Water Treatment Works) drought permit	No
Humber Estuary SPA	River Trent (Hall Water Treatment Works) drought permit	No
Humber Estuary Ramsar Site	River Trent (Hall Water Treatment Works) drought permit	No
River Wensum SAC	River Wensum (Costessey groundwater sources) drought permit	Yes
Breckland SPA	Wellington Wellfield drought permit	No
Breckland SAC	Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit	Yes
Norfolk Valley Fens SAC	Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit	No

The HRA screening has indicated that there are four supply side drought permit options that require further assessment and will be subject to the principles of the Stage 2 Appropriate Assessment, to identify if they can meet the requirements of the integrity test and if further survey, assessment and mitigation development is required to provide greater certainty of any conclusions. In the previous HRA undertaken for DP19, the River Wensum (Costessey groundwater sources), River Nene (Wansford Intake/ Rutland Water) and River Great Ouse (Offord Intake) supply side drought options were also taken through to Stage 2 Appropriate Assessment. Additionally, Wellington Wellfield drought permit has been taken through to Stage 2 Appropriate Assessment due to the potential adverse effects on the Breckland SAC.

3.2.1 River Trent (Hall Water Treatment Works) drought permit

Unlike DP19, the screening assessments concluded no LSEs for River Trent (Hall Water Treatment Works) drought permit. This is due to negligible hydrological, geomorphological and water quality impacts being identified through the DP22 EAR. Some concerns regarding the Humber SAC and in particular sea and river lamprey were raised through consultation with the Environment Agency, but a temporary increase in abstraction from the proposed drought permit is not considered likely to affect these species. However as outlined in the screening, due to remaining uncertainty regarding passability for lamprey at Cromwell Weir, a further assessment and monitoring on this is recommended.

3.2.2 Qualifying Features Summary

A summary of the qualifying features and associated supply side drought permit options being screened in for Stage 2 Appropriate Assessment is presented below in Table 3.4.

Table 3.4

Table 3.4: Summary of the outcome of the HRA Screening Assessment of the supply side drought permit options in Anglian Water's draft Drought Plan 2022, indicating individual qualifying features which require Stage 2 Appropriate Assessment due to potential likely significant effects on European designated sites.

Designated site and Supply site drought permit option	Qualifying features	Likely significant effect?
Ouse Washes SAC		
River Great Ouse (Offord Intake) drought permit	Spined loach	Yes
Ouse Washes SPA		
River Great Ouse (Offord Intake) drought permit	Bewick's swan (non-breeding)	Yes
	Black-tailed godwit (breeding)	Yes
	Gadwall (breeding)	Yes
	Garganey (breeding)	Yes
	Hen harrier (wintering)	Yes
	Mallard (breeding)	Yes
	Pintail (wintering)	Yes
	Ruff (breeding)	Yes
	Northern shoveler (breeding)	Yes
	Northern shoveler (wintering)	Yes
	Eurasian Teal (wintering)	Yes
	Whooper swan (wintering)	Yes
	Wigeon (wintering)	Yes
	Breeding bird assemblage	Yes
	Waterbird assemblage	Yes
Ouse Washes Ramsar site		
River Great Ouse (Offord Intake) drought permit	Bewick's swan (wintering)	Yes
	Pintail (wintering)	Yes
	Northern shoveler (wintering)	Yes
	Teal (wintering)	Yes
	Whooper swan (wintering)	Yes
	Wigeon (wintering)	Yes
	Washland	Yes
	Waterbird assemblage (wintering)	Yes
	Wetland bird assemblage	Yes
	Wetland invertebrate assemblage	Yes
	Wetland plant assemblage	Yes
Nene Washes SAC		
River Nene (Wansford Intake/ Rutland Water) drought permit	Spined loach	Yes
Nene Washes SPA		
River Nene (Wansford Intake/ Rutland Water) drought permit	Bewick's swan (wintering)	Yes
	Black-tailed godwit (breeding)	Yes
	Gadwall (breeding)	Yes
	Gadwall (wintering)	Yes
	Garganey (breeding)	Yes
	Pintail (wintering)	Yes
	Northern shoveler (breeding)	Yes
	Northern shoveler (wintering)	Yes
	Eurasian Teal (wintering)	Yes
	Wigeon (wintering)	Yes
Nene Washes Ramsar		
River Nene (Wansford Intake/ Rutland Water) drought permit	Bewick's swan (wintering)	Yes
	Wetland bird assemblage (breeding)	Yes
	Wetland invertebrate assemblage	Yes
	Wetland plant assemblage	Yes
River Wensum SAC		
River Wensum (Costessey groundwater sources) drought permit	Water courses of plain to montane levels with *R. fluitantis*	Yes
	Demoulin's whorl snail	Yes
	Freshwater crayfish	Yes

Designated site and Supply site drought permit option	Qualifying features	Likely significant effect?
	Brook lamprey	Yes
	Bullhead	Yes
Rutland Water SPA		
River Nene (Wansford Intake/ Rutland Water) drought permit	Coot (wintering)	Yes
	Gadwall (wintering)	Yes
	Goldeneye (wintering)	Yes
	Goosander (wintering)	Yes
	Great crested grebe (wintering)	Yes
	Mute swan (wintering)	Yes
	Shoveler (wintering)	Yes
	Teal (wintering)	Yes
	Tufted duck (wintering)	Yes
	Wigeon (wintering)	Yes
	Waterbird assemblage	Yes
Rutland Water Ramsar		
River Nene (Wansford Intake/ Rutland Water) drought permit	Gadwall (wintering)	Yes
	Shoveler (wintering)	Yes
	Waterbird assemblage (wintering)	Yes
Breckland SAC		
Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit	Inland dunes with open *Corynephorus* and *Agrostis* grasslands	No
	Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* – type vegetation	Yes
	European dry heaths	No
	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites)	No
	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	Yes
	Great crested newt	Yes

4 Information to Inform Stage 2 Appropriate Assessment

4.1 Baseline – Ouse Washes SAC

Covering a total area of approximately 3.11km², the Ouse Washes SAC lies between The Hundred Foot/ New Bedford River to the south-east and the Old Bedford River/ Counter Drain to the north-west. These rivers fall within the boundary of the Ouse Washes SSSI. The SAC is located approximately 19.5km from the Offord intake and 28.6km downstream via hydrological connectivity.

The primary reason for the designation of Ouse Washes SAC is due to the presence of Annex II species, the spined loach (*Cobitis taenia*) under Article 4(4) of the Directive (92/43/EEC). Whilst spined loach has a broad European range, in the UK it appears to be restricted to just five east-flowing river systems in eastern England: River Trent, Welland, Witham, Nene and Great Ouse, with their associated waterways[34]. In England, the overall trend in Conservation Status for spined loach populations is showing that they are stable and the best single value for population size within a 1km x 1km grid square from 2013 – 2018 was 175[35]. Spined loach has limited means of dispersal, so UK populations are largely genetically isolated from each other[34].

The Ouse Washes SAC support a healthy population of spined loach due to the clear waters of Old Bedford River and adjacent Counter Drain areas, which are abundant with a diversity of macrophytes. The total abundance of spined loach in the Ouse Washes SAC account for <2% of the population in the UK, but data is limited[36] and no further information is publicly available. Under the Conservation Objectives for the Ouse Washes SAC, spined loach density should be maintained ≥ 0.52 individuals/m² [37].

4.1.1 Conservation Objectives

The Conservation Objectives for the Ouse Washes SAC are outlined in 'European Site Conservation Objectives for Ouse Washes Special Area of Conservation Site Code: UK0013011 (Natural England, 2014)'. They ensure that the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:

- The extent and distribution of the habitats of qualifying species;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which the habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

4.1.2 Site condition

The Ouse Washes SAC is legally underpinned by the Ouse Washes SSSI. Natural England's SSSI site condition assessment based over 2009 and 2011 recognised that:

- 15.56% of the SSSI is assessed to be in Favourable Condition
- 3.57% Unfavourable – recovering, and
- 80.87% was recorded as Unfavourable – no change.

[34] Environment Agency (2005). Genetics and ecology of spined loach in England: Implications for conservation management. Science Report: SC000026/SR.
[35] JNCC (2018). European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC). Fourth Report by the United Kingdom under Article 17. 1-20.
[36]JNCC (2015). Natura 2000 – Standard Data Form, Ouse Washes. Natura 2000 Database, 1 – 10.
[37] Natural England (2015). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Ouse Washes Special Area of Conservation (SAC) (UK0013011). Natural England, 1 – 12.

4.2 Baseline – Ouse Washes SPA

The Ouse Washes SPA is located in eastern England, between the Old and New Bedford Rivers. It is an extensive area (22.47km²) that seasonally floods creating wet grassland ('washland') that acts as a floodwater storage system during the winter months. The SPA overlaps with the Ouse Washes SAC and corresponds with much of the area comprising the Ouse Washes SSSI. The SPA is located approximately 19.5km from the Offord intake and 28.6km downstream via hydrological connectivity.

The cycle of winter storage of floodwaters from the river and traditional summer grazing by cattle, as well as hay production, have given rise to a mosaic of rough grassland and wet pasture, with a diverse and rich fauna and flora. The washlands support both breeding and wintering waterbirds. In summer, there are important breeding numbers of several wader species, as well as spotted crake (*Porzana porzana).* In winter, the site holds very large numbers of swans, ducks and waders. During severe winter weather elsewhere, the Ouse Washes can attract waterbirds from other areas due to its relatively mild climate (compared with continental Europe) and abundant food resources. In winter, some wildfowl, especially swans, feed on agricultural land surrounding the SPA.

The Ouse Washes SPA qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

- 151 Ruff; *Philomachus pugnax* (breeding);
- 037 Bewick's Swan; *Cygnus columbianus bewickii* (wintering);
- 082 Hen Harrier; *Circus cyaneus* (wintering); and
- 038b Whooper Swan *Cygnus cygnus* (wintering).

This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

- 156a Black-tailed godwit; *Limosa limosa limosa* (breeding);
- 051 Gadwall; *Anas strepera* (breeding);
- 056 Northern shoveler; *Anas clypeata* (breeding and wintering);
- 054 Northern pintail; *Anas acuta* (wintering);
- 050 Eurasian wigeon; *Anas penelope* (wintering);
- 705 Mallard; *Anas platyrhynchus* (breeding); and
- 055 Garganey; *Anas querquedula* (breeding).

The area qualifies as a wetland of international importance under Article 4.2 of the Directive (79/409/EEC) by regularly supporting an overwintering assemblage of at least 20,000 waterfowl.

Over winter, the area regularly supports 64,392 individual waterfowl (5-year peak mean between 1991/2 and 1995/6) including lapwing (*Vanellus vanellus*), coot (*Fulica atra*), tufted duck (*Aythya fuligula*, mallard, Eurasian teal (*Anas crecca*), great cormorant (*Phalacrocorax carbo*), black-tailed godwit, common pochard (*Aythya ferina*), northern shoveler, northern pintail, gadwall, Eurasian wigeon, ruff, whooper swan and Bewick's swan.

4.2.1 Conservation Objectives

The Conservation Objectives for the Ouse Washes SPA are outlined in 'European Site Conservation Objectives for Ouse Washes Special Protection Area Site Code: UK9008041[38]'. They are to ensure that the integrity of the site is maintained or restored as appropriate and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and

[38] Natural England (2015). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Ouse Washes Special Area of Conservation (SAC) (UK0013011). Natural England, 1 – 12.

- The distribution of the qualifying features within the site.

4.2.2 Site condition

The Ouse Washes SPA is legally underpinned by the Ouse Washes SSSI. Natural England's SSSI site condition assessment based over 2009 and 2011 recognised that:

- 15.56% of the SSSI is assessed to be in Favourable Condition
- 3.57% Unfavourable – recovering, and
- 80.87% was recorded as Unfavourable – no change.

4.3 Baseline – Ouse Washes Ramsar site

Largely located within the boundary of the Ouse Washes SPA and Ouse Washes SSSI, the Ramsar site consists of an area of 25.14km². The Ramsar site seasonally floods creating wetted grassland (washland) habitat that is managed in a traditional, agricultural manner. The washlands support nationally and internationally important numbers of wintering waterfowl and nationally important numbers of breeding waterfowl. The site also consists of a large area of unimproved neutral grassland communities and several watercourses that support a diversity of aquatic flora. Like the SAC and SPA, the Ouse Washes Ramsar site is located approximately 19.5km from the Offord intake and 28.6km downstream via hydrological connectivity.

This site qualifies for classification as a Ramsar site under the following Criteria:

Ramsar Criterion 1

- The site is one of the most extensive areas of seasonally-flooding washland of its type in Britain;
- The site supports several nationally scarce plants, including: small water pepper (*Polygonum minus*), whorled water-milfoil (*Myriophyllum verticillatum*), greater water parsnip (*Sium latifolium*), river waterdrop wort (*Oenanthe fluviatilis*), fringed water-lily (*Nymphoides peltate*), long-stalked pondweed (*Potamogeton praelongus*), hair-like pondweed (*Potamogeton trichoides*), grass-wrack pondweed (*Potamogeton compressus*), tasteless water-pepper (*Polygonum mite*), marsh dock (*Rumex palustris*);
- The site holds relict fenland fauna, including the large darter dragonfly (*Libellula fulva*) and rifle beetle (*Oulimnius major*); and
- The site supports a diverse assemblage of nationally rare breeding waterfowl associated with seasonally-flooding wet grassland.

Ramsar Criterion 5

- Assemblages of international importance; and
- Species with peak counts in the winter: 59,133 waterfowl (5-year peak mean between 1998/99 and 2002/03).

Ramsar Criterion 6

- Species/ populations occurring at levels of international importance;
- Winter: Bewick's swan, whooper swan, Eurasian wigeon, gadwall, Eurasian teal, northern pintail, northern shoveler; and
- Species identified subsequent to designation for possible future consideration: mute swan (*Cygnus olor*), common pochard and black-tailed godwit.

4.3.1 Conservation Objectives

There are currently no Conservation Objectives for Ramsar sites however the Conservation Objectives of the SAC and SPA applies and information in the Ramsar Sites Information Service has been considered.

4.3.2 Site condition

The Ouse Washes Ramsar is legally underpinned by the Ouse Washes SSSI. Natural England's SSSI site condition assessment based over 2009 and 2011 recognised that:

- 15.56% of the SSSI is assessed to be in Favourable Condition
- 3.57% Unfavourable – recovering, and
- 80.87% was recorded as Unfavourable – no change.

4.4 Sensitivities of Qualifying Features associated with Ouse Washes

Site Improvement Plans (SIPs) have been developed for the Ouse Washes which cover both the SAC and SPA[39]. The prioritised threats/ pressures for the Ouse Wash SAC and SPA that could be affected by the Offord intake drought permit are:

- **Inappropriate water levels** - Flooding during spring / early summer severely damages suitable breeding habitat for northern shoveler, ruff and black tailed godwit by flooding nests. Prolonged summer flooding disrupts essential management of the washland, affecting the condition of the grassland for breeding birds in subsequent spring/ summer season(s). Deep flooding during winter also impacts overwintering birds such as Eurasian wigeon and wetland fauna, especially invertebrate populations. Habitat creation to offset historical decline of breeding and wintering birds and other strategies to alleviate flooding are measures noted in the SIP to reduce likelihood of inappropriate water levels in future.
- **Water pollution** - Inappropriate levels of nutrients from diffuse pollution in combination with inappropriate water levels from flooding have adversely affected the extent/ composition of vegetation communities on the washes. Resulting changes to the grassland mosaic has potential to affect the notified bird interests by destroying habitat suitable for many of the birds that visit or breed at the site. Occasional incidences of low oxygen levels on River Delph and Counter Drain have potential to impact spined loach populations.

Site condition assessment for Ouse Washes SSSI highlights that the majority of SSSI units which are classified as unfavourable, correspond with areas of washland grassland habitats (neutral lowland grassland). This is based on the decline of the majority of breeding bird features, some wintering bird features, as well as the loss of extent and quality of MG11/MG13 neutral grasslands. The reasons for these adverse conditions are cited as a combination of inappropriate water levels, freshwater pollution and agriculture/ run off.

Within the supplementary advice for the Ouse Washes SAC[40], the main attributes for the qualifying feature spined loach that could be affected by the Offord intake drought permit include:

- **Cover of submerged and marginal vegetation** – Submerged and marginal vegetation provide important refuge for spined loach and spawning sites.
- **Water quality (Nutrient enrichment)** - Nutrient enrichment can lead to a decline in substrate condition for spined loach due to benthic algal growth and associated enhanced siltation. It also increases the risk of impacts on the cover of the submerged plant community, which the spined loach uses for cover.
- **Water quality (organic and nonorganic pollution)** - The spined loach is susceptible to both episodic and chronic organic pollution. Episodic pollution causes direct mortalities whilst chronic pollution affects substrate condition through the build-up of sediment oxygen demand and excessive microbial populations. If the organic content of the substrate becomes too high,

[39] Natural England (2014). Site Improvement Plan Ouse Washes. Improvement Programme for England's Natura 2000 Sites (IPENS). Natural England, 1 – 10.
[40] Natural England (2015). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Ouse Washes Special Area of Conservation (SAC) (UK0013011). Natural England, 1 – 12.

reduced oxygen availability near the sediment/water interface may lead to enhanced egg and juvenile mortality. Spined loach can be affected by a range of other pollutants. A wide range of pollutants may impact on habitat integrity depending on local circumstances.

- **Conservation measures –** Maintaining management strategies that protect and sustain the structure, function and supporting processes associated with spined loach.
- **Biotope mosaic –** Maintain the diversity of microhabitats within the SAC including bare substrate and submerged macrophytes that support spined loach during different life stages.
- **Population size –** Changes to the physical, chemical or hydrological conditions of the SAC could impact on the sites ability to maintain the abundance of spined loach and contribute to achieving Favourable Conservation Status across the species spatial range in the UK.
- **Juvenile densities –** Changes to the physical, chemical or hydrological conditions of the SAC could impact on the sites capacity to support juvenile spined loach.
- **Flow regime -** Maintain a flow regime which is characteristic of the river channels.
- **Sediment regime –** Maintain in-channel substrate character of at least 20% sand and no more than 40% silt[40].

Within the supplementary advice for the Ouse Washes SPA[41], the main attributes for the qualifying features that could be affected by the Offord intake drought permit include:

- **Water quality/ quantity for all species and assemblages** – Poor water quality and reduced water levels can adversely affect the availability and suitability of breeding, feeding and roosting habitats within the SPA. In 2015, the phosphate concentrations in the field drains were too high and phosphorus and nitrogen concentrations in the Bedford Ouse River supplying water to the Washes also remain high. High nutrient concentrations can affect the abundance and diversity of macrophytes and associated aquatic invertebrates, impacting on the availability of prey species for waterbird assemblages in the SPA.
- **Food availability within supporting habitat** – Particularly for dabbling/surface feeding species (gadwall, Eurasian teal, northern pintail, garganey, northern shoveler, Bewick's swan and whooper swan) within the SPA, the maintenance of macrophyte and associated aquatic invertebrate abundance and diversity in the site is vitally important for successful breeding, adult fitness and survival. This is similarly the case for waders that rely on benthic invertebrate abundance and diversity (ruff and black-tailed godwit).
- **Conservation measures for all species and assemblages** – For waterbird assemblages in the SPA it is vital that SIP threats and pressures including appropriate water levels and water pollution are addressed.
- **Population abundance** – Maintaining and restoring population abundance of qualifying features within the SPA requires appropriate management of the site, to ensure the availability of suitable habitat conditions for both breeding and non-breeding species. Deteriorations in water quality could have an indirect impact on population abundance if macrophyte diversity for dabbling/ surface feeding species reduces, food availability and the capacity of the site declines.
- **Hydrology/ flow –** Changes in water supply or flow within the SPA can have significant impacts on qualifying bird species. Targets to ensure flooding does not cover >30% of the site during the nesting season have been implemented as well as targets to maintain water levels in ditches, scrapes and natural water depressions.

[41] Natural England (2019). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Ouse Washes Special Protection Area (SPA), Site Code: UK9008041. Natural England, 1 – 47.

- **Water area/ water depth –** Maintain the area and depth of multiple open water habitats to support nesting, feeding, roosting and rearing of young. Bewick's swan for example, require >0.1km² area (optimal) at <1m depth for over half of the total water area[42].

4.5 Baseline – Nene Washes SAC

The Nene Washes are located approximately 11.95km from Wansford intake/ Rutland Water and 16.82km downstream via hydrological connectivity. The Nene Washes covers 15km² and is one of the UKs few remaining areas of washland habitat, supporting waterbird assemblages of national and international importance.

The florally diverse areas of rough grassland and wet pasture create differing sward structures that provide feeding and nesting habitats for a range of waterbird species. Additional winter feeding is provided by the remaining arable crop. The Nene Washes also provide functionally linked/ supporting habitat for the Ouse Washes when waterbird populations are displaced during flood events.

The network of dykes within the Nene Washes also support a diversity of aquatic macrophytes including frogbit (*Hydrocharis morsus-ranae*), water violet (*Hottonia palustris*) and flowering rush (*Butomus umbellatus*). Moreton's Leam, a large 14th century drainage channel running along the eastern flank of the Nene Washes, contains the highest recorded density of spined loach in England. It is one of only four remaining locations for this species in the UK.

The site is maintained by inundation and this is controlled through a Water Level Management Plan (WLMP). The washlands are used for the seasonal uptake of floodwaters. In winter, the Stanground Sluice, which connects Morton's Leam to the River Nene, is kept open at a reduced gauge of 6 inches to provide a freshening flow and maintain water levels for designated sites until the growing season begins. Under low winter flows (typically December to March), the Stanground Sluice, which connects Morton's Leam to the River Nene, is closed. Consequently, during winter the River Nene is normally only connected to Morton's Leam and hence the Nene Washes during periods of flood flow, where connection will be either through automatic opening of Stanground Sluice (once the river reaches 3.8mODN), or via the Cradge Bank spillway[43]. However, there are three licences (held by the RSPB and the Whittlesey Wildfowlers & Conservationists) that allow abstraction of water from Morton's Leam to enable artificial flooding of the Nene Washes to maintain the wetlands and there may be occasions during the winter months when a comparatively small amount of water is allowed to enter the Morton's Leam to meet this need.

In the summer months, flow through Stanground Sluice maintains levels in Morton's Leam and the Nene Washes. This is important for wet fencing, irrigation and nature conservation. The optimal summer flow is 15Ml/d. If the flow at Stanground Sluice is insufficient, RSPB can operate the Gravel Dyke Feed to provide extra River Nene flow into the Washes[44]. During the summer months, the area has traditionally been used for cattle grazing.

The Nene Washes SAC is designated under Article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- 1149 Spined loach.

4.5.1 Conservation Objectives

The Conservation Objectives for the Nene Washes SAC are outlined in 'European Site Conservation Objectives for Nene Washes Special Area of Conservation Site Code: UK0030222[45]'. With regards to the SAC and qualifying features for which the site has been designated and which are subject to natural

[42] Natural England (2019). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Ouse Washes Special Protection Area (SPA), Site Code: UK9008041. Natural England, 1 – 47.

[43] Atkins (2015). Drought Plan Environmental Assessment Update. River Nene: Wansford Intake (Rutland Water), Version 7.0.
[44] Environment Agency (2011). Lower Nene Operating Procedures.
[45] Natural England (2018). European Site Conservation Objectives for Nene Washes Special Area of Conservation Site code: UK0030222. Natural England, Version 3. 1-2.

change, the Conservation Objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:

- The extent and distribution of the habitats of qualifying species;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which the habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

4.5.2 Site condition

The Nene Washes SAC is legally underpinned by the Nene Washes SSSI. Natural England's SSSI site condition assessment based over 2009 and 2010 recognised that:

- 19.96% of the SSSI is assessed to be in Favourable Condition; and
- 80.04% Unfavourable – recovering.

4.6 Baseline – Nene Washes SPA

See **Section 4.5** above for baseline details about the Nene Washes SPA.

The site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

- 037 Bewick's swan (*Cygnus columbarius bewickii*) (wintering).

This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

- 156a Black-tailed godwit (breeding);
- 051 Gadwall (breeding and wintering);
- 056 Northern shoveler (breeding and wintering);
- 054 Northern pintail (wintering);
- 050 Eurasian wigeon (wintering);
- 055 Garganey (breeding); and
- 052 Eurasian teal (wintering).

4.6.1 Conservation Objectives

The Conservation Objectives for the Nene Washes SPA are outlined in 'European Site Conservation Objectives for Nene Washes Special Protection Area Site Code: UK9008031[46]'. With regard to the SPA and the species for which the site has been designated and subject to natural change, the Conservation Objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features;
- The structure and function of the habitats of the qualifying features;
- The supporting processes on which the habitats of the qualifying features rely;
- The population of each of the qualifying features; and,
- The distribution of the qualifying features within the site.

[46] Natural England (2019). European Site Conservation Objectives for Nene Washes Special Protection Area Site code: UK9008031. Natural England, Version 3. 1-2.

4.6.2 Site condition

The Nene Washes SPA is legally underpinned by the Nene Washes SSSI. Natural England's SSSI site condition assessment based over 2009 and 2010 recognised that:

- 19.96% of the SSSI is assessed to be in Favourable Condition; and
- 80.04% Unfavourable – recovering.

4.7 Baseline – Nene Washes Ramsar site

See **Section 4.5** above for baseline details about the Nene Washes Ramsar site.

This site qualifies for classification as a Ramsar under the following Criteria:

Ramsar Criterion 2

- Supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
- Supports an important assemblage of nationally rare breeding birds.
- Supports a wide range of raptors occur through the year.
- Supports several nationally scarce plants, and two vulnerable and two rare British Red Data Book invertebrate species have been recorded.

Ramsar Criterion 6

- Supports 1% of the individuals in a population of one species or subspecies of water bird.
- Species/populations occurring at levels of international importance.
- Species with peak counts in winter: Bewick's swan.
- Species/populations identified subsequent to designation for possible future consideration:
- Spring/autumn - black-tailed godwit.
- Winter - Northern pintail.

4.7.1 Conservation Objectives

There are currently no Conservation Objectives for Ramsar sites however the Conservation Objectives of the SAC and SPA applies and information in the Ramsar Sites Information Service has been considered.

4.7.2 Site condition

The Nene Washes Ramsar site is legally underpinned by the Nene Washes SSSI. Natural England's SSSI site condition assessment based over 2009 and 2010 recognised that:

- 19.96% of the SSSI is assessed to be in Favourable Condition; and
- 80.04% Unfavourable – recovering.

4.8 Sensitivities of Qualifying Features associated with Nene Washes

4.8.1 Spined loach

Spined loach are in the true loach family (Cobitidae), described as Old World freshwater fish. They are found in shallow, slow-flowing or stagnant water in all manner of waterbodies (e.g. rivers, streams, canals, ditches, drains and lakes). Optimal habitat is thought to be clear oxygen-rich water, with dense or patchy, submerged macrophyte cover and fine-particle substrate, such as mud and sand.

Spined loach are nocturnal; they stay hidden under rocks or buried in sand or mud during the day. They are most active at night, when they filter small benthic invertebrates and organic matter from the

sediment for food. They possess the ability of intestinal breathing, meaning that when water is oxygen-poor they swallow air at the water's surface bringing oxygen into the intestine, where it is absorbed into the bloodstream. The spawning season is from April to June. Females typically produce 300 to 1,500 eggs close to the ground (e.g. on stones, roots or plants), which are then fertilized by the males. The larvae hatch in four to six days and their expected lifespan is between three and five years[47]

Spined loach are sensitive to changes in a number of environmental variables, including water quality, temperature, salinity, flow and water levels. Nutrient enrichment is of particular concern, as it promotes benthic algal growth and increased siltation, which could degrade the condition of substrate relied upon by spined loach for spawning and feeding. An increase in nutrients (e.g. phosphate and nitrate) can also result in algal blooms in lentic systems, leading to a decrease in light attenuation and consequently reduced submerged macrophyte cover. An increase in microbial remineralization at the sediment surface due to the influx of organic matter could also result in low dissolved oxygen concentrations. Although spined loach have the stop-gap measure of intestinal breathing when dissolved oxygen levels are low, their preference is for oxygen-rich environments. Persistent anoxia at the sediment-water interface could lead to population decline due to enhanced egg and juvenile mortalities[4849].

SIPs have been developed for the Nene Washes which cover both the SAC and SPA as part of the IPENS[50]. The prioritised threats/ pressures for the Nene Wash SAC and SPA that could be affected by the Wansford intake/ Rutland water drought permit are:

- **Hydrological changes –** This is a threat associated with the breeding and non-breeding waterbird assemblages that require water levels to be maintained within optimal range for feeding activity. Monitoring of bird abundance and water levels throughout the year will provide insight for key stakeholders and support suitable responses to environmental changes.
- **Water pollution –** This is a threat for spined loach and requires regular monitoring of water quality within Mortons Leam and surrounding ditches[50].

Within the supplementary advice for the Nene Washes SAC[51], the main attributes for the qualifying feature spined loach that could be affected by the Wansford intake/ Rutland water drought permit are:

- **Cover of submerged macrophytes –** Maintain a sufficient proportion of submerged aquatic macrophytes within the SAC as this provides both shelter and spawning sites for spined loach.
- **Water quantity/ quality –** Fluctuations in water quality and quantity can affect the structure and function of wetland habitats within the SAC, which are vitally important for spined loach. Of note this includes dissolved oxygen, ammonia, biochemical oxygen demand and phosphorus[51].
- **Conservation measures –** Maintaining management strategies that protect and sustain the structure, function and supporting processes associated with spined loach. Water pollution has been identified as a SIP threat to spined loach populations within the Nene Washes SAC.
- **Population size –** Changes to the physical, chemical or hydrological conditions of the SAC could impact on the sites ability to maintain the abundance of spined loach and contribute to achieving Favourable Conservation Status across the species spatial range in the UK.
- **Juvenile densities –** Changes to the physical, chemical or hydrological conditions of the SAC could impact on the sites capacity to support juvenile spined loach.
- **Flow regime -** Maintain a flow regime that is characteristic of the river as this is critical for the survival of spined loach throughout its life cycle.
- **Sediment regime –** Maintain substrate character at no more than 40% silt[52].

[47] FishBase (2018). Spined-loach (Cobitis taenia). Accessed from: http://www.fishbase.org/summary/Cobitis-taenia.html
[48] Vostradovsky, J (1973). Freshwater fishes. The Hamlyn Publishing Group Limited, London.
[49] English Nature (1998). The habitat and management requirements of spined loach Cobitis taenia. No 244 – English Nature Research Reports.
[50] Natural England (2014). Site Improvement Plan Nene Washes. Improvement Programme for England's Natura 2000 Sites (IPENS). Natural England, 1 – 9.
[51] Natural England (2019). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Nene Washes Special Area of Conservation (SAC), Site Code: UK0030222. Natural England, 1 – 12.

4.8.2 Internationally important bird assemblage

The Nene Washes hosts an internationally important assemblage of waterfowl and waders during the breeding and over-wintering seasons. The key threats to birds within this assemblage are inappropriate water levels, water quality degradation and changes to sediment transport and deposition processes. Flooding during spring and early summer can severely damage the breeding bird interest by flooding nests, drowning young and degrading habitat. Deep flooding during winter impacts on the overwinter bird population, again due to habitat loss. Disruption of the normal sediment transport and deposition processes resulting from flow velocity changes could also result in habitat loss. Nutrient enrichment can lead to invertebrate, fish and macrophyte species decline, which could compromise food availability for waterfowl.

Within the supplementary advice for the Nene Washes SPA[52], the main attributes for the qualifying features that could be affected by the Wansford intake/ Rutland water drought permit are:

- **Water quality/ quantity -** Fluctuations in water quality and quantity can affect the structure and function of wetland habitats within the SPA, affecting the availability of suitable habitat for breeding, feeding and roosting. Therefore, it is important that surface water quality and quantity are maintained at a standard which provides the necessary conditions to support qualifying features of the SPA.
- **Food availability within supporting habitat -** particularly for dabbling/surface feeding species (gadwall, Eurasian teal, northern pintail, garganey, northern shoveler and Bewick's swan) within the SPA, the maintenance of macrophyte and associated aquatic invertebrate abundance and diversity in the site is vitally important for successful breeding, adult fitness and survival. This is similarly the case for waders that rely on benthic invertebrate abundance and diversity (black-tailed godwit).
- **Conservation measures for all species and assemblages** – for waterbird assemblages in the SPA it is vital that the hydrological changes are managed appropriately in accordance with the SIP threat.
- **Population abundance** – maintaining and restoring population abundance of qualifying features within the SPA requires appropriate management of the site, to ensure the availability of suitable habitat conditions for both breeding and non-breeding species. Deteriorations in water quality could have an indirect impact on population abundance if macrophyte diversity for dabbling/ surface feeding species reduces, food availability and the capacity of the site declines.
- **Hydrology/ flow -** Changes in water supply or flow within the SPA can have significant impacts on qualifying bird species. Maintain hydrological processes to ensure continuity of water availability in feeding sites, with visible areas of standing shallow water during non-breeding period and reductions in water levels as the breeding season approaches (<5 – 15% per month).
- **Water area/ water depth –** Maintain the area and depth of multiple open water habitats to support nesting, feeding, roosting and rearing of young. Bewick's swan for example, require >0.1km² area (optimal) at <1m depth for over half of the total water area[53].

4.9 Baseline – River Wensum SAC

The extent of this assessment is largely defined by the presence of the River Wensum SAC, which is adjacent to and in direct hydrological continuity with the Costessey groundwater sources. The River Wensum is a SAC for 71km of its 73km length and is considered to be one of the best examples in the UK of a naturally enriched calcareous lowland river, with over 100 species of plants, a rich invertebrate

[52] Natural England (2019). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Nene Washes Special Protection Area (SPA), Site Code: UK9008031. Natural England, 1 – 57.
[53] Natural England (2019). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, Nene Washes Special Protection Area (SPA), Site Code: UK9008031. Natural England, 1 – 57.

fauna and a relatively natural corridor. The upper reaches of the river are fed by springs that rise from the chalk and by run-off from calcareous soils rich in nutrients, which gives rise to dense beds of submerged and emergent vegetation characteristic of a chalk stream. Further downstream, the chalk is overlain with boulder clay and river gravels.

The River Wensum SAC is designated under Article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (rivers with floating vegetation often dominated by water-crowfoot).

The River Wensum SAC is also designated under Article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- White-clawed crayfish (*Austropotamobius pallipes*);
- Desmoulin's whorl snail (*Vertigo moulinsiana*);
- Brook lamprey (*Lampetra planneri*); and
- Bullhead (*Cottus gobio*).

In addition to the qualifying species present in the SAC, the river supports abundant brown trout (*Salmo trutta fario*), which form the major component of the fish community of the upper Wensum, whilst the middle and lower reaches are dominated by chub (*Leuciscus cephalus*), pike (*Esox Lucius*), eel (*Anguilla anguilla*) and barbel (*Barbus barbus*). Common kingfisher (*Alcedo atthis*) and little grebe (*Tachybaptus ruficollis*) breed along the river[54]. These species are not considered for this assessment as they are not part of the qualifying features of the SAC.

4.9.1 Conservation Objectives

The Conservation Objectives for the River Wensum SAC are outlined in 'European Site Conservation Objectives for River Wensum Special Area of Conservation site code: UK0012647'[55]. With regard to the SAC and the natural habitats and/or species for which the site has been designated and subject to natural change, the Conservation Objectives are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring:

- The extent and distribution or qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

4.9.2 Site condition

The River Wensum SAC is legally underpinned by the River Wensum SSSI. Natural England's SSSI site condition assessment based over 2009 and 2010 recognised that:

- 11.05% of the SSSI is assessed to be in Favourable Condition;
- 47.70% Unfavourable – recovering; and
- 41.25% Unfavourable – no change.

[54] JNCC (2015). River Wensum SAC Natura 2000 – Standard Data Form. EU Code: UK0012647. Completion date: March 2001.
[55] Natural England (2018). European Site Conservation Objectives for River Wensum Special Area of Conservation Site code: UK0012647. Natural England, Version 3. 1-2.

4.10 Sensitivities of Qualifying Features associated with the River Wensum SAC

4.10.1 Water courses with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

The River Wensum is a naturally enriched, calcareous lowland river that supports water-crowfoot *Ranunculus* species sporadically across much of the river's length. There are several variants of this habitat in the UK, with the River Wensum representing sub-type 1. Stream water-crowfoot (*Ranunculus penicillatus,* subspecies *pseudofluitans*) is the dominant *Ranunculus* species but thread-leaved water-crowfoot (*Ranunculus trichophyllus*) and fan-leaved water-crowfoot (*Ranunculus circinatus*) also occur[56]. Due to the habitat heterogeneity of the River Wensum, it supports diverse macroinvertebrate assemblages that use the macrophytes for shelter, feeding and spawning[5657]. Therefore, deterioration of *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation will have a direct impact on macroinvertebrate communities. This habitat is sensitive to pollution and changes in hydrology which can affect the population dynamics. Flow velocity is thought to be the single most important control on the condition of *Ranunculus*[58].

4.10.2 White-clawed crayfish

White-clawed crayfish occur in relatively hard, mineral-rich waters on calcareous and rapidly weathering rocks. Flowing water habitats in which they have been found often have undermined, overhanging banks, with sections with heterogeneous flow patterns, as well as cobbles and rock riffles, roots and woody vegetation, and under water-saturated logs or weirs and boulders that provide suitable refuges[59]. They tend to inhabit watercourses with a depth between 0.75m and 1.25m, with low water levels increasing their vulnerability to predation[59]. Flow conditions that affect bankside vegetation and submerged plant communities in which crayfish use for refuge, may have indirect consequences to white-clawed crayfish. Further, increased silt loads (and turbidity) caused by flow changes (natural or induced) can clog the gills of crayfish[59]. White-clawed crayfish prefer well aerated waters with a dissolved oxygen of greater than 60% saturated (i.e. the 90th percentile)[60].

Signal crayfish out-compete white-clawed crayfish and also carry crayfish plague (*Aphanomyces astaci*) a fungal disease that wipes out white-clawed crayfish populations. This species is listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and included on Section 41 of the NERC Act 2006 making it a priority species in England. The white-clawed crayfish is also an Annex II species under the European Habitats Directive (1992) making it a primary driver in the selection of the Wensum SAC.

4.10.3 Desmoulin's whorl snail

Desmoulin's whorl snail is the largest *Vertigo* species, with a shell height of up to approximately 2.6mm. The distribution of Desmoulin's whorl snail in the UK is mainly confined to the south east of England, stretching from east Dorset to north – west Norfolk[61] . The snail lives on reed grasses and sedges, such as reed sweet-grass (*Glyceria maxima*), and tussocks of greater pond-sedge (*Carex riparia*) and lesser pond-sedge (*C. acutiformis*), where it feeds on the microflora. In autumn, it may ascend taller reeds and

[56] English Nature (2005). Citation for Special Area of Conservation (SAC), River Wensum. EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora. Designation citation. English Nature, 1.
[57] Ricardo Energy and Environment (2021). Anglian Water Drought Plan Wensum (Costessey groundwater sources) 2022, Environmental Assessment. Report for Anglian Water Services, Ricardo Confidential.
[58] Hatton-Ellis, T.W. and Grieve, N. (2003). Ecology of Watercourses Characterised by Ranunculion fluitantis and Callitricho-Batrachion Vegetation. Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.
[59] Natural England (2014). Site Improvement Plan: River Wensum. Natural England, 1 – 11.
[60] Peay, S. (2002). Guidance on habitat for white-clawed crayfish and its restoration. Environment Agency Technical Report W1-067/TR, 1-43.
[61] Kileen, I.J. (2003). Ecology of Desmoulin's Whorl Snail. Conserving Natura 2000 Rivers Ecology Series No.6. England Nature, Peterborough, 1-27.

scrub[62]. Desmoulin's whorl snail is considered a terrestrial gastropod but is associated with permanently wet habitats, including calcareous swamps, fens and marshes, and riparian margins. It lives on living and dead stems and leaves of tall plants and grazes on fungi, micro-algae and bacteria growing on marsh plants, and decaying higher plants[61]. The hydrological regime associated with these environments is essential for this species to survive. The snail is dependent on the maintenance of high-water levels and standing water[63] and is susceptible to extreme fluctuations in groundwater levels, potentially inducing intolerable hydrological conditions.

Consequently, a stable hydrogeology with highly humid conditions is required, which is met by a high-water table below the stands of vegetation[64]. This must be close to the surface so that the ground never dries out and even in high summer water will rise when the ground is trodden[64]. There is evidence that there is hydrological connectivity between the River Wensum levels and SSSI units. For this reason, changes to the water level in the river may affect unit moisture levels and consequently impact Desmoulin's whorl snail habitat conditions.

Tattersfield and McInnes (2002)[65] conducted a comprehensive study detailing the relationship between the hydrological regime and densities of Desmoulin's whorl snail within the Norfolk Valley Fens (SAC) and Kennet and Lambourn floodplains in Berkshire. Maximum snail densities were recorded at sites where water levels were consistently above the ground surface throughout the year (mean annual level 0.25m). Using this data, the authors calculated the critical minimum summer water level threshold to be 0.5mbgl, i.e. below surface groundwater, inferring that snails would be able to survive but in relatively small numbers for a finite period[65].

Desmoulin's whorl snail is listed under Annex II of the European Union Habitat and Species Habitat Directive and is considered a priority species in the UK Biodiversity Action Plan (BAP). The International Union for Conservation of Nature (IUCN) consider this species to be vulnerable.

4.10.4 Brook lamprey

The lampreys belong to the Agnatha group, being amongst the most primitive living vertebrates. Most lamprey species have a similar lifecycle, with suitable spawning grounds comprising clean gravel beds with areas of soft marginal silt/sand in shallow waters with moderate current. The adults breed in reeds constructed from the gravel and the juveniles live buried in silt beds. In the UK, spawning of brook lamprey in British rivers starts when the water temperature reaches 10–11ºC, usually in March and April. Lampreys are susceptible to disturbance and pollution at any stage during their life cycle. Brook lamprey are sensitive to pentachlorophenol, and of average sensitivity to copper. Due to their low fecundity and dispersal rates it is postulated that lampreys are sensitive to rapid changes in environmental variables.

4.10.5 Bullhead

Bullhead is the only freshwater cottid found in the UK. It is a bottom-living fish that inhabits a variety of rivers, streams and stony lakes. It requires good water quality, a stony substrate free from excessive siltation and sufficient cover from overhanging vegetation or woody debris. Bullheads spawn from February to June; typically once for females in upland streams, and up to four times in warmer lowland streams[66]. Bullheads are susceptible to changes in oxygen saturation and temperature, with critical thermal limits of -4.2 and 27.7ºC[66].

[62] JNCC, 2015. River Wensum SAC Natura 2000 – Standard Data Form. EU Code: UK0012647. Completion date: March 2001
[63] House, R.H., Thompson, R.J, & Acreman, M., (2016). Projecting impacts of climate change on hydrological conditions and biotic responses in a chalk valley riparian wetland. Journal of Hydrology. 534, 178-192.
[64] Wade, M., 2013. Costessey Pits Groundwater Investigation, 2013 – A Review of the Ecological in-river needs. Draft August 2013 JPP3172-R-002a RPS Unpublished.
[65] Tattersfield, P. and Mcinnes, R. (2002). Hydrological requirements of Vertigo moulinsiana on three candidate Special Areas of Conservation in England (Gastropoda, Pulmonata: Vertiginidae). Heldia, 5, 135-147.
[66] Tomlinson, M. L and Perrow, M. R. (2003). Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough, 1-19.

SIPs have been developed for the River Wensum SAC as part of the IPENS[67]. The prioritised pressures for the River Wensum SAC that could be affected by the Costessey groundwater sources drought permit are:

- **Siltation –** This pressure can affect submerged macrophytes within the river, white clawed crayfish and brook lamprey. To reduce siltation in the River Wensum the implementation of a Diffuse Water Pollution Plan (DWPP) is required.
- **Water abstraction –** This pressure can affect submerged macrophytes within the river, Desmoulin's whorl snail, white clawed crayfish and brook lamprey. To reduce the impacts of water abstraction the implementation of measures in the Restoring Sustainable Abstraction Programme is required[67].

Within the supplementary advice for the River Wensum[68], the main attributes for the qualifying features that could be affected by the Costessey groundwater sources drought permit are:

- **Extent of the feature associated with the site** – Restore the extent of rivers with floating vegetation dominated by water-crowfoot while maintaining the natural river habitat function[69]. There are acceptable variations in extent based on natural fluctuations and dynamic change.
- **Biotope (habitat mosaic) –** Restore the extent and pattern of in-channel and riparian habitats, including a variety of substrate types, flows, bank profiles and in-channel vegetation cover to support a diverse biological community.
- **Water course flow -** Restore the natural flow regime of the River Wensum, with daily flows as close to 'naturalised flow' in the absence of abstractions and discharges. Overall water resource management is guided by the Broadland Rivers Catchment Abstraction Management Strategy (CAMS) and the Environment Agency's Review of Consents. This identified that the upper reaches are over-licenced but historic usage has not exceeded flow targets and downstream of the Costessey public water abstraction, the river is over-abstracted. Actions for moving the abstraction point outside the SAC boundary have been identified in AMP5/6.
- **Sediment regime –** Sediment supply can be interrupted by extraction which can have indirect impacts on biodiversity and river management. The target is to restore the natural supply of course and fine sediments to the River Wensum.
- **Key structural, influential and/ or distinctive species –** Restore the abundance of qualifying habitat and species present within the SAC.
- **Vegetation structure: cover of submerged macrophytes –** Restore a sufficient proportion of all submerged macrophyte species. This target for the SAC could be affected by water quality and quantity variations during the operation of the proposed drought permit.
- **Water chemistry – alkalinity –** maintain the natural levels of alkalinity in the River Wensum by remaining dependent on groundwater supply for in-river flows.
- **Water quality – nutrients and biological –** Restore the natural nutrient regime of the river, including phosphates, total nitrogen, un-ionised ammonia. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this supporting habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed.
- **Population abundance –** Restore to maintain and increase population abundance of qualifying species within the SAC to a level that contributes to its Favourable Conservation Status across its natural range in the UK.
- **Conservation measures –** Desmoulin's whorl snail relies on a water table at or slightly above or below ground surface level to maintain damp conditions within the habitat. This is achieved

[67] Natural England (2014). Site Improvement Plan River Wensum. Improvement Programme for England's Natura 2000 Sites (IPENS). Natural England, 1 – 11.
[68] Natural England (2019). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, River Wensum Special Area of Conservation (SAC), Site Code: UK0012647. Natural England, 1 – 56.
[69] Natural England (2009). River Wensum restoration strategy. Natural England, Sheffield, England.

by hydrological connectivity with natural water sources including aquifers, shallow groundwater seepage or the river network.

- **Oxygen levels –** maintain high dissolved oxygen levels in the River Wensum to ensure the availability of benthic invertebrates, macrophytes, algae and small fish that provide vital prey species for several qualifying species within the SAC.
- **Juvenile densities -** Impacts on physical, chemical or hydrological integrity may suppress juvenile densities of qualifying species within the SAC[70].

4.11 Baseline – Rutland Water SPA

Covering a total area of approximately 15.55 km², the Rutland Water SPA is a reservoir in Rutland, England, east of the county town, Oakham (NGR: SK 906 071). The site is located within the Leicestershire and Nottinghamshire Wolds National Character Area (NCA) where the reservoir is a significant feature in the rural, open, mixed farmland landscape of undulating hills and steep-sided valleys. The underlying geology is formed of Jurassic rocks of limestone, sandstone and ironstone overlain by glacial tills which gives rise to moderately fertile soils composed of loams and clays. As a result, arable farming dominates the plateaux tops while the steep-sloping valley support more pastural farming. The clays in the Gwash valley helped provide material for the construction of the dam which created Rutland Water.

Rutland Water SPA was notified as a SPA in 1991 before being registered in 1996. Rutland Water SPA provides water to the East Midlands and is filled from the River Nene and River Welland by pumping. The reservoir is by area the largest water body in England and by capacity, the second largest. Since 1975, it has developed into a major wetland of international importance for waterbirds which are attracted to the large expanses of open water, lagoons, islands, mudflats, reedswamp, marsh, old meadows, pastures, scrub and mature woodland.

This site qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

- A051 Gadwall (non-breeding); and
- A056 Northern shoveler (non-breeding)

The area qualifies as a wetland of international importance under Article 4.2 of the Directive (79/409/EEC) by regularly supporting an overwintering assemblage of at least 20,000 waterfowl.

4.11.1 Conservation Objectives

The Conservation Objectives for the Rutland Water SPA are outlined in 'European Site Conservation Objectives for Rutland Water Special Protection Area Site Code: UK9008051 (Natural England, 2019)'.

They ensure that the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:

- The extent and distribution of the habitats of qualifying species;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which the habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

4.11.2 Site condition

Rutland Water SPA is legally underpinned by Rutland Water SSSI. Natural England's SSSI site condition assessment conducted in 2021 of three units recognised that:

- 100% of the SSSI is assessed to be in Favourable Condition

[70] Natural England (2019). European Site Conservation Objectives: Supplementary advice on conserving and restoring site features, River Wensum Special Area of Conservation (SAC), Site Code: UK0012647. Natural England, 1 – 56.

4.12 Baseline – Rutland Water Ramsar site

The Ramsar site only includes the areas of open water in the eastern section of the site outside the Nature Reserve area. Within the Nature Reserve, the Ramsar site boundary follows the SSSI and SPA boundary except for Lax Hill and some woodland parcels. Over 45% of Rutland Water is managed by the Leicestershire & Rutland Wildlife Trust and Anglian Water as a nature reserve.

This site qualifies for classification as a Ramsar site under the following Criteria:

Ramsar Criterion 5

- Bird assemblages of international importance.
- Species with peak counts in winter – 19,274 waterfowl (5 year peak mean 1998/9 – 2002/3)

Ramsar Criterion 6

- The site is qualified for species/ populations occurring at levels of international importance including gadwall (1,014 individuals, representing an average of 1.6% of the population, 5 year peak mean 1998/9 – 2002/3) and Northern shoveler (619 individuals, representing an average of 1.5% of the population, 5 year peak mean 1998/9 – 2002/3).

4.12.1 Conservation Objectives

There are currently no Conservation Objectives for Ramsar sites however the Conservation Objectives of the SPA applies and information in the Ramsar Sites Information Service has been considered.

4.12.2 Site Condition

Rutland Water Ramsar site is legally underpinned by Rutland Water SSSI. Natural England's SSSI site condition assessment conducted in 2021 of three units recognised that:

- 100% of the SSSI is assessed to be in Favourable Condition

4.13 Sensitivities of Qualifying Features associated with Rutland Water

A SIP has been developed for the Rutland Water which covers the SPA and SSSI[71]. The prioritised threats/ pressures for the Rutland Water SPA that could be affected by the Rutland intake drought permit are:

- **Inappropriate water levels** - Water levels of the reserve are managed primarily for public water supply and water storage and not specifically for non-breeding water birds. This can influence the number of specific species of non-breeding waterbirds using the site at certain times of year. Work is being undertaken to establish and maintain suitable compensatory habitats for waterfowl assemblages within adjacent lagoons during extreme drawdown events. Potential impacts during implementation of the proposed drought permit involve a reduction in the extent of shallow foraging habitat for qualifying birds of the SPA and Ramsar site.
- **Water pollution** - Inappropriate levels of nutrients such as phosphorus from diffuse pollution in combination with inappropriate water levels from abstraction have previously adversely affected the extent/ composition of algal communities on the reservoir. Changes to the algae and macrophyte communities has the potential to affect the notified bird interests by destroying habitat suitable for many of the birds that visit or feed at the site.
- **Invasive species** – Invasive species present a significant alteration to food-webs which can lead to dramatic decreases in some taxa and changes in species composition. Development of a non-native invasive species strategy is required and should be considered when discharging water from the River Nene to Rutland Water.

[71] Natural England (2021). Site Improvement Plan Rutland Water. Improvement Programme for England's Natura 2000 Sites (IPENS). Natural England, 1 – 10.

Within the supplementary advice[72] for the Rutland Water SPA, the main attributes for the qualifying features that could be affected by the River Nene (Wansford Intake/ Rutland Water) drought permit include:

- **Water quality/ quantity** – Ensure water quality and quantity is maintained and managed to a standard which provides the necessary conditions to support the qualifying bird species during migration and overwintering.
- **Water depth –** Maintain the availability of suitable shallow foraging habitat at the optimal depth of <0.25 m in Burley Fishponds, Heron Bay, Manton Bay, Lagoons 1 – 8 and adjacent shallow water in the North and South Arms.
- **Food availability –** Maintain high cover/ abundance of macrophytes, terrestrial vegetation, surface plankton and invertebrates in ensure ample food availability for the qualifying bird species.

4.14 Baseline – Breckland SAC

Breckland SAC is located in East Anglia within the Brecks NCA, on an undulating plateau underlain with Cretaceous chalk bedrock[73]. It covers an area of approximately 75.48km² and predominately consists of dry grassland (60%), with heath/scrub (20%), woodland (14%) and inland waterbodies, improved grassland, other arable land, inland rocks and other land (6%, including towns, villages, roads, waste places, mines and industrial sites) making up the remainder of the site. The formation of habitat mosaics across the SAC have largely been influenced by the highly variable soil composition which includes sand, silt, clay and flints[74].

Breckland SAC qualifies under Article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- H2330 Inland dunes with open *Corynephorus* and *Agrostis* grasslands
- H3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* – type vegetation.
- H4030 European dry heaths
- H6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)(*important orchid sites)
- H91E0 Alluvial forests with common alder (*Alnus glutinosa*) and ash (*Fraxinus excelsior*) (*Alno-Padion, Alnion incanae, Salicion albae*)*

Breckland SAC also qualifies under Article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- S1166 Great crested newt (*Triturus cristatus*)

4.14.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

[72] Natural England (2018). Rutland Water Special Protection Area (SPA) Site code: UK9008051, European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Natura 2000, 1 – 16.
[73] English Nature (2005). Breckland SAC UK0019865. Designation Citation, Version 1. 1 – 2.
[74] Natural England (2019). Breckland Water Special Area of Conservation (SAC) Site code: UK0019865, European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Natura 2000, 1 – 58.

4.14.2 Site Condition

The Breckland SAC is legally underpinned by a number of SSSIs including the following:

- Barnhamcross Common SSSI;
- Berner's Heath, Icklingham SSSI;
- Bridgeham and Brettenham Heaths SSSI;
- Cavenham – Icklingham SSSI;
- East Wretham Heath SSSI;
- Field Barn Heaths, Hillborough SSSI;
- Foxhole Heath, Eriswell SSSI;
- Gooderstone Warren SSSI;
- Grime's Grave SSSSI;
- Lakenheath Warren SSSI;
- RAF Lakenheath SSSI;
- Stanford Training Area SSSI;
- Thetford Golf Course and Marsh SSSI;
- Thetford Heaths SSSI;
- Wangford Warren and Carr SSSI;
- Weather and Horn Heaths, Eriswell SSSI; and
- Weeting Heath SSSI

As part of the Stage 1 Screening, Stanford Training Area SSSI was identified as the associated SSSI with groundwater dependent qualifying features present. Therefore, the site condition of this SSSI has been provided; 54.71% Unfavourable – Recovering, 42.12% Favourable, 3.12% Unfavourable – No change and 0.05% Unfavourable – Declining.

4.14.3 Sensitivities of Qualifying Features associated with Breckland SAC

A SIP has been developed for Breckland, which covers the SAC and SPA. None of the prioritised threats or pressures have been identified that would overlap with the impact pathways identified from the Wellington Wellfield drought permit.

Within the supplementary advice[75] for Breckland SAC, the main attributes for the qualifying features that could be affected by the Wellington Wellfield drought permit include:

- **Extent of the feature within the site** – Maintain the extent of natural eutrophic lakes within the fluctuating meres at 0.22km². Fluctuating meres are restricted to Norfolk Breckland. Due to natural fluctuations in water level, with periods where the lakes completely dry out, the actual cover of water is typically lower than 0.22km².
- **Water quality/ quantity** – Meeting the groundwater environmental standards of lowland, alkalinity rivers set out in the Water Framework Directive (WFD 2000/60/EC) is sufficient for the alluvial forests and great crested newt populations.
- **Permanence of ponds** – For great crested newt this is important as ponds are used for breeding, foraging and sustaining availability of prey species.

[75] Natural England (2019). Breckland Water Special Area of Conservation (SAC) Site code: UK0019865, European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Natura 2000, 1 – 58.

5 Stage 2 Appropriate Assessment

5.1 River Great Ouse (Offord Intake) drought permit

5.1.1 Overview

Table 5.1 below provides a summary of the potential adverse effects of the proposed drought permit downstream of the Offord intake on the Ouse SAC, SPA and Ramsar site. Note that flow regime assessments within the Environmental Assessment Reports (EARs) are based on denaturalised flows (Section 4.3). Comparison of the implementation of the proposed drought permit with naturalised flows is also considered in the following Stage 2 Appropriate Assessment of the River Great Ouse (Offord Intake) drought permit.

Table 5.1: Potential adverse effects of the River Great Ouse (Offord intake) drought permit on the Ouse SAC, SPA and Ramsar site.

Impact	Details
Flow regime	The zone of influence for this drought option includes the Ouse Washes and has been determined as the reach from Offord Intake to Salters Lode. Only Reach 2 overlaps with the designated site boundaries of the Ouse Washes SPA and Ramsar site. Hydrological impact assessments have not been undertaken for the Old Bedford River associated with the Ouse Washes SAC. Stage 1 In Reach 1 (immediately downstream of Offord intake) and Reach 2 (between Bedford Ouse at Brownshill Staunch and Ely Ouse at Denver Complex), no reductions in flow regime during annual Q_{99} is anticipated in comparison to naturalised flows. Considering denaturalised flows, in Reach 1 an 8.6% reduction during summer Q_{99} flows is anticipated. During the annual Q_{99}, a 10.7% reduction is anticipated. In Reach 2, a 7.2% reduction in flow regime during summer Q_{99} is anticipated and an 8.9% reduction during annual Q_{99} in comparison to denaturalised flows (see Section 4.3 of 'River Great Ouse: Offord Intake (Grafham Water) EAR' for more detail on flow regime calculations based on denaturalised flows). Stage 2 In Reach 1, a 32% reduction in the flow regime during annual Q_{99} is anticipated in comparison to naturalised flows. In Reach 2, a 30.7% reduction in the flow regime during annual Q_{99} is anticipated in comparison to naturalised flows. Considering denaturalised flows, in Reach 1 a 34.3% reduction during summer Q_{99} flows is anticipated. During the annual Q_{99}, a 33.5% reduction is anticipated. In Reach 2, a 28.8% reduction in flow regime during summer Q_{99} is anticipated and a 28.0% reduction during annual Q_{99} in comparison to denaturalised flows.
Water quality	Phosphate concentration and the associated low dissolved oxygen problems that result from eutrophication and algal blooms, as well as elevated ammonia levels, are the main water quality concerns in the River Great Ouse. During periods of low flow, the river will have a lower dilution capacity. As a result, the concentrations of nutrients, metals and biochemical oxygen demand are likely to increase slightly downstream of the Offord intake during implementation of a drought permit. The impact is predicted to be more pronounced in summer than in winter. However, WRC discharges and flow inputs from tributaries will increase the dilution capacity further downstream.
Suspended sediment/ siltation	Stage 1 Within Reach 1 and Reach 2, the operation of the Stage 1 drought permit in summer is predicted to lead to minor impacts on river geomorphology. However, increased flows in winter are likely to offset the impacts and therefore, a minor impact on geomorphology within Reach 1 and 2 could be expected. Stage 2 Within Reach 1, the operation of the Stage 2 drought permit in summer is predicted to lead to moderate impacts on river geomorphology. During winter, the drought permit is predicted to lead to minor impacts on geomorphology. As Reach 2 is level controlled, the impact on river geomorphology is deemed to be moderate during the summer. During winter the change in flow is assessed to result in minor impacts on geomorphology.
Habitat loss	The main mechanism for habitat loss at European sites is indirectly through the occurrence of other potential impacts such as alterations to water levels and flow which can cause flooding/ drought conditions or water quality deterioration, as mentioned above.

5.1.2 Flow regime

Hydrological impact assessments have confirmed that in Reach 2 (from Bedford Ouse at Brownshill Staunch to Ely Ouse at Denver Complex, SSSI unit 22), which overlaps with the boundaries of the Ouse Washes SPA and Ramsar site, the Offord intake drought permit will have the following impacts: In Reach 1, a 32% reduction in the flow regime during annual Q_{99} is anticipated in comparison to naturalised flows. In Reach 2, a 30.7% reduction in the flow regime during annual Q_{99} is anticipated in comparison to naturalised flows.

SSSI unit 22 has no botanical interest based on condition assessments of the Ouse Washes SSSI[76], therefore, it is not anticipated that changes in flow regime will impact on supporting habitat (macrophyte communities) of qualifying bird species, that are present in the internal ditch system. As the New Bedford River which runs from the Bedford Ouse at Earith to the River Great Ouse at Denver is tidal[77], hydrological impacts within Reach 2 are likely to be alleviated by the tidal influence from the Wash. Therefore, it is not anticipated that adverse effects to the site integrity of the Ouse Washes SPA and Ramsar site are likely to occur.

Therefore, the potential adverse effects due to reductions in flow (particularly during Stage 2 in the summer) must be considered further as part of Stage 2 Appropriate Assessment.

Note that no hydrological impact assessment was undertaken for the Old Bedford River associated with the Ouse Washes SAC. This is because the Old Bedford River only takes flows from the River Great Ouse during high flow periods when the Earith Sluice gate is opened to provide additional flood storage[78]. As the drought permit proposed will be operational during low flows a hydrological impact assessment was not deemed necessary.

5.1.3 Water quality and habitat loss

Due to the anticipated reductions in water flow as a result of the proposed drought permit, there is potential for water quality deterioration, which could cause the following changes in watercourses of the Ouse Washes SAC, SPA and Ramsar site:

- Increase in phosphate concentration;
- Increase in ammonia concentration; and
- Increase in biological oxygen demand

Currently, the majority of the Ouse Washes SSSI, which overlaps with the European designated sites is in unfavourable – no change condition (80.71%). More specifically, unit 22 which overlaps with Reach 2 is currently in favourable condition, due to supporting breeding birds along its margins, including sedge warbler (*Acrocephalus schoenobaenus*) and reed bunting (*Emberiza schoeniclus*). Reach 2 is located within the boundaries of the Ouse Washes SPA and Ramsar site. However, the Old Bedford River associated with SSSI units 18 and 22 are currently in unfavourable – recovering condition, because of water pollution. A Diffuse Water Pollution Plan has been agreed by the Environment Agency and Natural England to improve current site conditions[76]. The Old Bedford River is within the boundaries of the Ouse Washes SAC, SPA and Ramsar site.

Dilution of contaminants and excess nutrients in the River Great Ouse will be dependent on discharges into the river and wider catchment between the intake location and Ouse Washes. In order to further assess the current condition of the European designated sites waterbodies, in relation to water quality, data from Environment Agency monitoring stations has been reviewed for various locations across the

[76] Natural England (2011). Condition of SSSI Units for Site Ouse Washes SSSI. Designated Sites View. Accessed from: https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1000503&ReportTitle=Ouse Washes SSSI
[77] Environment Agency (2021) Advice and information for River Users Wishing to Navigate the Tidal Hundred Foot or New Bedford River. Accessed from: https://goba.org.uk/wp-content/uploads/2021/02/Tidal100ftAdvicev3.pdf
[78] Environment Agency (2017). Great Ouse Tidal River Baseline Report.

River Great Ouse. The environmental assessment analysed the existing water quality baseline results at six locations including Offord (near the intake location), Brownhill Staunch and St Ives Road Bridge (upstream of the Ouse Washes SAC/ SPA/ Ramsar site) and three sites along the Hundred Foot River including Welney Bridge (within boundary of SSSI, SPA and Ramsar site). These are presented within **Table 5.2** below. Note that no water quality impact assessment was undertaken for the Old Bedford River associated with the Ouse Washes SAC. However, as the Environment Agency transfer water from the tidal river into the counter drain at the Old Bedford Sluice for subsequent abstraction by the Internal Drainage Board for spray irrigation, Old Bedford River could be exposed to water quality changes during drought permit operation. Therefore, identified deteriorations in water quality in Reach 2 will also be applied to the Old Bedford River, associated with the Ouse Washes SAC.

Table 5.2: Baseline water quality Water Framework Directive Environmental Quality Standards assessment for 2010 – 2020.

	Determinant:	DO Saturation (10%ile)	BOD (90%ile)	Ammonia (90%ile)	pH (5-95%ile)	Orthophosphate (AA*)
	Units:	**%**	**mg/l**	**mg/l**	**pH**	**mg/l**
	WFD 'Good' EQS:	**60**	**5**	**0.6**	**6-9**	**0.12**
Environment Agency Monitoring Locations	Offord	85.3	2.33	0.27	7.77 - 8.31	0.24
	Hundred Foot River Earith Rd. Br.	85.44	4.88	0.12	7.89 - 8.74	0.24
	Hundred Foot River Mepal Rd. Br.	79.08	3.09	0.17	7.83 - 8.68	0.23
	Hundred Foot River Welney Br.	76.79	5.68	0.24	7.78 - 8.67	0.21
	Brownhill Staunch	83.32	5.93	0.16	7.78 - 8.76	0.21
	St. Ives Rd. Br.	78.73	3.32	0.14	N/A	0.21

Source: The Environment Agency open source data. *DO: Dissolved oxygen. AA: Annual average.

	Compliant with EQS
	Non-compliant with EQS
N/A	No/insufficient data available

The WFD status for biochemical oxygen demand in the waterbodies relevant to this assessment is currently High or Good. However, at Hundred Foot River Welney Bridge and Brownhill Staunch biochemical oxygen demand is currently not compliant with WFD 'Good' Environmental Quality Standards (EQS)[79]. Based on the Supplementary Advice for the Ouse Washes SAC, biochemical oxygen demand should be equivalent to chemical General Quality Assessment (GQA) Class 'C', which is 6 mg/l[80]. Based on Environment Agency monitoring station data, Reach 2 associated with the New Bedford River is currently below that threshold for both biochemical oxygen demand. Dissolved oxygen saturation is currently compliant with WFD 'Good' EQS and is most likely associated with the structure of the channel, which is artificially deep, with slow flows to maintain a navigable draught. It is also within the threshold of 60% (10%tile) of the GQA Class 'C', fairly good criteria. Water quality assessments determined that due to a lack of sensitivity presented by dissolved oxygen saturation to reductions in flow in the New Bedford River, minor changes in dissolved oxygen saturation were predicted. As current conditions for dissolved oxygen saturation are sufficiently above the GQA Class 'C' threshold, it is not anticipated that the drought permit will result in dissolved oxygen saturation declining below the 'fairly good' criteria. However, there is potential for the drought permit to cause the biochemical oxygen demand to increase beyond the GQA Class 'C' threshold, particularly at Hundred Foot River Welney Br. and Brownhill Staunch monitoring stations; the former station is within the boundaries of the Ouse Washes SPA and Ramsar site. This could be due to increased algal growth caused by elevated nutrient concentrations.

Orthophosphate (as soluble reactive phosphorus) concentrations are not compliant with the WFD 'Good' EQS thresholds at each monitoring station, including the three stations within the boundaries of the Ouse Washes SPA and Ramsar site. In addition, they are above the annual mean total phosphorus attribute target for the Ouse Washes SAC and Ouse Washes SPA of <0.1 mg/l. The risk of deterioration to orthophosphate concentrations during drought plan implementation Stage 1 is considered negligible in summer and minor in winter of Reach 2 (Bedford Ouse at Brownshill Staunch to Denver Sluice). The risk of deterioration to orthophosphate during operation of Stage 2 of the drought permit is considered major in summer and minor in winter. Implementation of the drought permit could cause phosphate concentrations to further exceed the attribute target for water quality of the Ouse Washes SAC and SPA and therefore, is not compliant with the Conservation Objectives of the European designated site aiming to achieve favourable conservation status.

Ammonia is currently classified as being of High status for the 'Ouse (Roxton to Earith)' and 'Old West River' waterbodies and Good in the 'Ely Ouse South Level' and 'Old Bedford River/River Delph' waterbodies. The GQA threshold for ammonia in Class 'C' is 1.3 mg/L N. At monitoring stations within the boundaries of the Ouse Washes SPA and Ramsar site, ammonia concentrations are currently below this value. The risk of deterioration to ammonia during drought plan implementation Stage 1 is considered negligible in summer and minor in winter of Reach 2. The risk of deterioration to ammonia during drought plan implementation Stage 2 is considered minor in summer and minor in winter. This assessment is due to the lack of sensitivity presented by ammonia to changes in flows at this site. It is deemed unlikely that a sufficient increase in ammonia is likely to occur, as a result of drought permit implementation above the GQA Class 'C' threshold.

Therefore, the implementation of the drought permit has the potential to result in adverse effects on orthophosphate concentrations and biochemical oxygen demand in the New Bedford River, which is within the boundaries of the Ouse Washes SPA and Ramsar site and Old Bedford River, as it is hydrologically connected to the River Great Ouse, downstream of Offord intake. Note that this is without consideration of mitigation measures (see Section 5.1.5).

[79] UKTAG (2013). UK Environmental Standards and Conditions, UK Technical Advisory Group on the Water Framework Directive.
[80] Natural England (2015). Ouse Washes Special Area of Conservation (SAC) (UK0013011). European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Natura 2000, 1 – 12.

5.1.4 Potential adverse effects on the qualifying features of the Ouse Washes European designated sites

5.1.4.1 Qualifying bird species of Ouse Washes SPA and Ramsar site

Considering potential adverse effects of the proposed drought permit alone, reduced flows in Reach 2 (New Bedford River) will decrease the dilution capacity of nutrients and pollutants that leach into the river system and increase the deposition of fine sediments. The New Bedford River (SSSI unit 22) supplies water through slackers to internal ditches of the SPA, during dry, unflooded summers. Although there is limited botanical interest in New Bedford River, the internal ditches which it supplies are notified for their botanical interest and support provided to breeding bird populations[81].

In addition to data recorded in New Bedford River, in 2015, high concentrations of phosphates above the 0.1 mg/l attribute target were also recorded in the internal ditches[82]. In the summer months during the operation of Stage 2 (in particular), when major hydrological impacts are anticipated, the drought permit has the potential to cause deterioration in the abundance and diversity of macrophyte communities as elevated phosphate concentrations favour algal growth, impacting on associated aquatic invertebrates and reducing the diversity of suitable foraging habitat for qualifying bird species. Therefore, the drought permit could directly impact on breeding bird species that preferentially feed on macrophytes and aquatic invertebrates including gadwall, garganey, mallard and northern shoveler. In addition, low flows during the summer will increase siltation and potentially reduce the ability of the watercourse to flush excess sediment in autumn, that is vitally important for the successful growth of *Ranunculus* species in summer.

Therefore, adverse effects on the availability of suitable foraging habitat are anticipated (in the absence of mitigation measures), affecting the overall structure and function of the Ouse Washes SPA. This is particularly concerning for breeding populations present during summer when Stage 2 is operational.

5.1.4.2 Spined loach: Qualifying feature of Ouse Washes SAC

It is recognised that spined loach is vulnerable to changes in water quality, including nutrient enrichment and organic and non-organic pollution. Under the condition of the drought permit, there is potential for the anticipated changes to water quality to lead to an increase in algal growth, including algal blooms, and eutrophication of waterbodies. This has the potential to be more pronounced in the backwater channels, such as the Counter Drain and associated side drains within the Ouse Washes.

The drought permit has the potential to result in benthic algal growth within the channels, on the substrates that support the spined loach. This could lead to increased levels of siltation which in the short term could produce sub-optimal feeding conditions for spined loach and in the long-term, cause declines in the abundance and composition of macrophytes that spined loach use for shelter and spawning. For optimal conditions substrates should be at least 20% sand and no more than 40% silt. Whilst the species can tolerate silt and mud, it has a preference for sandy substrate. High sediment cohesiveness is likely to adversely affect the feeding process[83]. Furthermore, eutrophication of water bodies can lead to a build-up of sediment oxygen demand and excessive microbial populations. Increased biochemical oxygen demand and the resultant reduced oxygen, can lead to physical stress and mortality of adult spined loach, and increased egg and juvenile mortality.

In the Counter Drain and Old Belford/ Delph River, the drought permit could have adverse effects on the structure and function of supporting habitats, the supporting processes on which the habitats of qualifying species rely, the populations of the qualifying species, and the distribution of qualifying

[81] Natural England (2011). Condition of SSSI Units for Site Ouse Washes SSSI. Designated Sites View. Accessed from: https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1000503&ReportTitle=Ouse Washes SSSI
[82] Natural England (2019). European Site Conservation Objectives: Supplementary Advice on conserving and restoring site features. Natura 2000, 1 – 47.
[83] Natural England (2015). European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Ouse Washes Special Area of Conservation (SAC) Site Code: UK0013011. Natura 2000, 1-12.

species within the SAC. This would otherwise act against the Conservation Objectives of the Ouse Washes SAC, without the implementation of appropriate mitigation measures.

5.1.4.3 Aquatic macrophytes and invertebrates associated with the Ouse Washes Ramsar site

The Ouse Washes is recognised under Criterion 1 of the Ramsar convention for its diverse assemblage of aquatic plants, a number of which are nationally scare, such as fringed water-lily and frogbit. The Ramsar site also supports notable invertebrate species such as the scarce chaser (*Libellula fulva*) and rifle beetle (*Oulimnius major*). These are particularly notable in the backchannels such as the Counter Drain and associated ditches.

The drought permit has potential to result in elevated nutrient levels as the dilution capacity of the river decreases, increasing the likelihood of excessive algal growth and risk of eutrophication within the Ouse Washes. If sustained over a prolonged period, this could lead to changes in community structure of aquatic macrophytes, while algal blooms could result in choking of segments. In addition, there is potential for increases in fine sediment deposition to adversely affect submerged macrophyte abundance and composition. Such changes in water quality would likely lead to a deterioration of supporting habitats and mortality to macroinvertebrate communities, without the implementation of appropriate mitigation measures.

5.1.5 Proposed Mitigation Measures

To prevent potential adverse effects due to water quality deterioration in the Ouse Washes SAC, it is proposed that during the operation of the drought permit there is a suspension on the transfer of water from the tidal river into the counter drain at the Old Bedford Sluice. This would prevent mixing of water from the main channel of the River Great Ouse with the Old Bedford River associated with the Ouse Washes SAC. The proposed suspension will require further discussion and agreement with the Environment Agency prior to implementation of the drought permit.

We acknowledge the potential for adverse effects on the SPA and Ramsar sites and will undertake further assessment to better understand the risk of the impact of the drought option on water quality in the Ouse Washes SPA and Ramsar site.

Potential mitigation measures are available to prevent the possible adverse effects due to water quality deterioration in the Ouse Washes SPA and Ramsar site. This includes the secondary and or tertiary treatment of wastewater discharges from Huntingdon Godmanchester WRC within Reach 2. This additional treatment would potentially involve phosphate stripping and aeration of discharged wastewater that is currently elevating orthophosphate levels in the River Great Ouse and increasing the biochemical oxygen demand.

Further assessment of the potential mitigation measures is required (potentially through further SAGIS modelling) to consider the current quality of the wastewater being discharged, the extent of the improvements via additional treatment and the impact on water quality concerns during implementation of the drought permit.

We will share the assessment results with the Environment Agency and Natural England and will liaise with the teams to determine appropriate mitigation measures in the event of requiring the permit.

5.1.6 Summary

The Appropriate Assessment has concluded that with the implementation of proposed mitigation measures, the drought permit will not result in adverse effects on the Ouse Washes SAC, SPA and Ramsar site.

Further detail of the proposed mitigation measures in **Section 5.1.5** is required to support the conclusion of no adverse effect on site integrity. This work will be scoped with NE and the EA. The completed work will be provided to relevant regulators prior to drought permit implementation.

A summary of the potential adverse effects on qualifying features of the designated sites, in accordance with relevant attributes of the Conservation Objectives and additional monitoring and mitigation

previously proposed is provided in **Table 5.3.** This monitoring plan has been developed based on discussions held with the Environment Agency for DP19, and in line with the DPG 2020.

Table 5.3: Potential adverse effects on Ouse Washes SAC, SPA and Ramsar site qualifying features in accordance with relevant attributes of the Conservation Objectives and monitoring and mitigation requirements.

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
Spined loach	Cover of submerged and marginal vegetation	- Submerged and marginal vegetation particularly during reduced flows in the summer of Stage 2 could impact on the abundance and diversity of macrophyte communities due to changes in water quality and siltation.	**Baseline measures (ongoing):** - Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application. - Confirm water quality and ecological baseline monitoring has been or is being conducted by the Environment Agency. - Initial consultation with stakeholders, including the Environment Agency. **Pre-drought measures (commence immediately before a drought):** - Enhanced, site-specific flow and water quality monitoring and ecological walkovers for fish and macrophytes and macroinvertebrate sampling to ensure accurate baseline of conditions. - Contact all licensed abstractors within the potentially affected reach. - Spot flow gauging at key sites along the River Great Ouse. - Regular liaison with the Environment Agency. **During drought measures (commence in drought period):** - Frequently monitor flow against temporary drought permit minimum residual flow (MRF). - Continued monitoring of water quality and biological community to quantify the immediate impact of the drought and the response of the biological community in the recovery period. - Regular liaison with the Environment Agency. M**itigation measures (commence on implementation of drought permit as/if needed):** - Cessation rules if parameters fall below pre-agreed levels, or if flows drop below MRF. - Variable abstraction to allow occasional pulses of water throughout the system. For example, pulsing with weeks on and off to mitigate impacts of permit on fish.
	Water quality (nutrient enrichment, organic and nonorganic pollution)	- Reduced water flow could result in increased organic/ non-organic pollution and nutrient concentrations in the Ouse Washes SAC, particularly orthophosphates that are already above the attribute target threshold of 0.1 mg/l and biochemical oxygen demand.	
	Conservation measures	- Site improvement plan threat relevant to spined loach is water pollution caused by increased nutrient exposure during flooding. As the drought permit will not be operational during high flows, no flooding will be caused by Offord intake and therefore, no adverse effects anticipated on conservation measures. Potential adverse effects identified on supporting macrophyte habitats during reduced flows.	
	Biotope mosaic	- The drought permit is not anticipated to change the physical characteristics of the River Great Ouse However, it may impact on the health, diversity and distribution of macrophyte communities that support spined loach populations.	
	Population size	- As a minimum standard, population density of spined loach must be maintained at or above 0.52 individuals/m² in the outer and inner rivers respectively. Data is currently limited on the current abundance of spined loach in the Ouse Washes SAC. Therefore, more information is required via monitoring in order to conclude no adverse effect from Offord intake.	
	Juvenile densities	- Reduced water flow could cause nutrient concentrations in the Ouse Washes SAC to increase, particularly if major hydrological impacts occur during Stage 2 in the summer. Water quality deterioration and increased siltation will also impact macrophyte communities used as feeding and sheltering sites for juvenile spined loach. Data is currently limited on the current abundance of spined loach in the Ouse Washes SAC. Therefore, more information is required via monitoring in order to conclude no adverse effect from Offord intake.	

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
	Flow regime	- The Old Bedford River only takes flows from the River Great Ouse during high flow periods when the Earith Sluice gate is opened to provide additional flood storage[84]. As the drought permit proposed will be operational during low flows a hydrological impact assessment was not deemed necessary. - No adverse effects to the flow regime of the Old Bedford River are anticipated.	- Phosphate removal at Anglian Water Services (AWS) Water Recycling Centres (WRCs). - Ammonia removal at storm tanks, combined sewage overflows (CSOs) and WRCs. - Aerators on standby if dissolved oxygen (DO) levels drop below an agreed threshold. - Potential modification of flood defence activities that are routine in summer and may cause sedimentation and phosphate mobilisation. - Dredging or weed clearance. - Remedial work to any of the lock structures between Offord and Hermitage Lock which cannot provide adequate draught. - Mitigation could be considered for backchannels with the possibility of "pump over" water into stranded backchannels at lower flows. - Should fish become stranded, an action plan could be implemented setting out the logistics and timing of relocation. **Post drought measures (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. - Review of approach to drought permit environmental monitoring and mitigation. A review of current site management and potential sediment monitoring methods before, during and after the operation of this drought option is recommended to prevent adverse effects on site integrity.
	Sediment regime	- Elevated nutrient concentrations in the Old Bedford River could lead to excessive algal growth and an increase in siltation within the Counter Drain. - In addition, Environment Agency transfer water from the tidal river into the counter drain at the Old Bedford Sluice for subsequent abstraction by the Internal Drainage Board for spray irrigation. Therefore, Old Bedford River could be exposed to increased suspended sediment loading during reduced flows associated with drought permit operation.	
Waterfowl and wader assemblage	Water quality/ quantity for all species and assemblages	- Reductions in flow during operation of Offord intake could impact on the extent of wetted habitat available for waterfowl assemblages associated with the Ouse Washes SPA and Ramsar site.	**Baseline measures (ongoing):** - Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application.

[84] Environment Agency (2017). Great Ouse Tidal River Baseline Report.

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
		- In addition, reduced flows may cause increases in nutrient concentrations in the River Great Ouse. As orthophosphates are currently above the attribute target of <0.1 mg/l the long-term implications on macrophyte and macroinvertebrate abundance and diversity is a concern, particularly during the operation of Stage 2 in the summer when breeding populations are present.	- Confirm water quality and ecological baseline monitoring has been or is being conducted by the Environment Agency. - Initial consultation with stakeholders, including the Environment Agency. **Pre-drought measures (commence immediately before a drought):** - Enhanced, site-specific flow and water quality monitoring and ecological walkovers for macrophytes and macroinvertebrate sampling to ensure accurate baseline of conditions. - Spot flow gauging at key sites along the River Great Ouse. - Regular liaison with the Environment Agency. **During drought measures (commence in drought period):** - Frequently monitor flow against temporary drought permit MRF. - Continued monitoring of water quality and biological community to quantify the immediate impact of the drought and the response of the biological community in the recovery period. - Regular liaison with the Environment Agency. M**itigation measures (commence on implementation of drought permit as/if needed):** - Cessation rules if parameters fall below pre-agreed levels, or if flows drop below MRF. - Phosphate removal at AWS WRCs. - Ammonia removal at storm tanks, CSOs and WRCs. - Aerators on standby if DO levels drop below an agreed threshold. - Potential modification of flood defence activities that are routine in summer and may cause sedimentation and phosphate mobilisation. - Dredging or weed clearance. - Remedial work to any of the lock structures between Offord and Hermitage Lock which cannot provide adequate draught.
	Food availability within supporting habitat	- Waterfowl assemblages feed on a range of food sources including macrophytes, invertebrates, amphibians and small mammals. Reduced flows and potential deteriorations in water quality as a result of the drought permit therefore, could have adverse effects on food availability for waterfowl assemblages of the SPA and Ramsar site.	
	Conservation measures	- The drought option will not impact on inappropriate water levels that cause flooding during high flows but it may reduce wetted habitat availability during the summer months when hydrological impacts will be most severe.	
	Population abundance	- Reduced flows will cause water quality deterioration that in turn, will impact on the health, diversity and extent of macrophyte communities - This could result in a decline in carrying capacity of suitable feeding, breeding, rearing and roosting habitat present in the Ouse Washes SPA and Ramsar site. - Adverse effects on long term population abundance could occur particularly during operation of Stage 2 of the drought permit in the summer, when breeding populations are present.	
	Hydrology/ flow	- As the New Bedford River which runs from the Bedford Ouse at Earith to the River Great Ouse at Denver is tidal[85], hydrological impacts within Reach 2 are likely to be alleviated by the tidal influence from the Wash. Therefore, it is not anticipated that adverse effects to the site integrity of the Ouse Washes SPA and Ramsar site are likely to occur.	

[85] Environment Agency (2021) Advice and information for River Users Wishing to Navigate the Tidal Hundred Foot or New Bedford River. Accessed from: https://goba.org.uk/wp-content/uploads/2021/02/Tidal100ftAdvicev3.pdf

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
			- Mitigation could be considered for backchannels with the possibility of “pump over” water into stranded backchannels at lower flows. **Post drought measures (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. - Review of approach to drought permit environmental monitoring and mitigation.

5.2 River Nene (Wansford Intake/ Rutland Water) drought permit

5.2.1 Nene Washes SAC, SPA and Ramsar site

5.2.1.1 Overview

Table 5.4 below provides a summary of the potential adverse effects on site integrity of the proposed drought permit downstream of the Wansford Intake based on hydrological, water quality and geomorphology impact assessments of Reach 1 (Wansford abstraction intake to Orton) and Reach 2 (from Orton to the Tidal Limit at Dog-in-a-Doublet). The impact assessments describe anticipated impacts of reaches of the River Nene within hydrological connectivity with the Nene Washes SAC, SPA and Ramsar site. See Sections 4.4 and 4.5 of the River Nene: Wansford Intake (Rutland Water) Drought Permit EAR for more detail on the methodology of the water quality and geomorphology assessments undertaken. Note that the EAR hydrological assessment is based on comparison of the drought permit implementation and denaturalised flows. The Stage 2 Appropriate Assessment of the River Nene (Wansford Intake/ Rutland Water) drought permit considered implementation of the drought permit in comparison to naturalised flows, in accordance with the supplementary advice.

Table 5.4: Potential impacts of the proposed River Nene (Wansford Intake/ Rutland Water) drought permit on the Nene Washes SAC, SPA and Ramsar site.

Impact	Details
Flow regime	The flow regime assessments have been undertaken in accordance with the attribute target in the supplementary advice, to 'maintain at least 90% of the naturalised daily mean flow in the river throughout the year'. Reach 1 (Wansford abstraction intake to Orton): No change in annual mean naturalised flow during the six-month operation of the drought permit is anticipated during annual Q_{99}. If the drought permit was in operation during the summer, no change in annual mean naturalised flow is anticipated during annual Q_{95}. If the drought permit was in operation during the winter, a <1% reduction in annual mean naturalised flow is anticipated during annual Q_{95}. Reach 2 (from Orton to the Tidal Limit at Dog-in-a-Doublet): No change in annual mean naturalised flow during the six-month operation of the drought permit is anticipated during annual Q_{99}. If the drought permit was in operation during the summer, no change in annual mean naturalised flow is anticipated during annual Q_{95}. If the drought permit was in operation during the winter, a <1% reduction in annual mean naturalised flow is anticipated during annual Q_{95}. The anticipated changes in flow regime are compliant with the Conservation Objectives of the Nene Washes SAC.
Water quality	Nutrient enrichment (especially orthophosphate) and the subsequent development of algal blooms and low dissolved oxygen concentrations are currently the only water quality concerns along the fluvial River Nene. Due to the high background concentrations of orthophosphate, and the significant flow reduction in this reach, the risk of deterioration to orthophosphate during drought plan implementation is considered major in summer and major in winter in both Reach 1 and 2.
Salinity regime	The potential reduction in River Nene freshwater flow to The Wash estuary during drought permit implementation may result in a small change in the salinity profile within the tidal stretch of the river. The extent of the salinity increase will be dependent on the magnitude of flow reductions. However, the increase in salinity in the lower reaches of the river is likely to be minimised by occasional flushing events, flow inputs from water recycling centres (WRCs) and tributaries, and by control of structural features along the river corridor. Additionally, the dominance of marine/estuarine processes within the tidal reach and in The Wash mean that salinity changes resulting from reduced MRF are not likely to have an adverse effect in the event of a drought permit being implemented.

Impact	Details
Suspended sediment / siltation	Reach 1: During the summer, major reductions in flow are likely to increase fine sediment deposition and therefore, have a moderate impact upon the natural morphological regime of the reach. During the winter, moderate to major impacts on geomorphology in Reach 1 are anticipated. Reach 2: During the summer, major reductions in flow are likely to increase fine sediment deposition and therefore, have a moderate impact upon the natural morphological regime of the reach. During the winter, moderate to major impacts on geomorphology in Reach 2 are anticipated.
Habitat loss	The main mechanism for habitat loss at European sites is indirectly through the occurrence of other potential impacts such as alterations to water levels and flow or chemical changes, as mentioned above. Hydro-dependent habitats in the downstream site may be sensitive to direct impacts, such as the erosion of saltmarsh through changes in sediment transport processes.

Water levels in the Nene Washes are maintained by inundation, which is controlled by a Water Level Management Plan (WLMP) and flows from the River Nene enter the Nene Washes and Moreton's Leam via Stanground Sluice. Therefore, no adverse effects on water levels within the designated site boundary are anticipated.

5.2.1.2 Flow regime

Within the supplementary advice for the Nene Washes SAC, the flow regime attribute target states that 'as a guideline at least 90% of the naturalised daily mean flow should remain in the river throughout the year'[86]. Stanground Sluice is constantly open, to differing extents in the summer in comparison to the winter. During the summer the sluice gate is fully open and during the winter the sluice gate is open by 6 inches to provide a freshening flow and maintain the water level for the designated site. Therefore, it is anticipated that the Nene Washes SAC, SPA and Ramsar site will be exposed to reduced water flow which could have an impact on the diversity, abundance and distribution of macrophyte communities present in Morton's Leam. This could have adverse effects on spined loach, breeding and wintering bird populations and aquatic invertebrates.

As the anticipated changes in flow regime are compliant with the Conservation Objectives of the Nene Washes SAC, no adverse effects in relation to flow regime are anticipated.

5.2.1.3 Water quality and habitat loss

A reduction in flows due to increased abstraction would reduce the dilution capacity of the river downstream from the Wansford intake. Nutrients and other pollutants discharged to the River Nene from point sources downstream of the abstraction point will, therefore, have a greater impact on water quality than they would under normal, non-drought permit conditions. As flows from the River Nene enter the Nene Washes and Moreton's Leam via Stanground Sluice, water quality changes in the river will be conveyed to the Washes. In addition, increased suspended sediment and therefore, siltation is also anticipated.

Within the supplementary advice for the Nene Washes SAC, there is an attribute target for soluble reactive phosphorus (orthophosphate) of 0.1 mg/L $^{-1}$ annual mean and within the supplementary advice for the Nene Washes SPA, there is an attribute target for orthophosphate of <0.1 mg/L^{-1} annual mean. Downstream of Wansford intake at Peterborough Town Bridge, the annual mean orthophosphate exceeded the attribute target by 0.05 mg/L from 2010 – 2020 and also, the WFD 'Good' EQS target of 0.12 mg/l (see **Table 5.5**). This monitoring station is upstream of the Nene Washes. Within the Nene Washes designated site, orthophosphate concentrations were just below the attribute threshold by 0.01mg/L at Morton's Leam. Therefore, there is a risk that during the operation of the proposed drought

[86] Natural England (2019). Nene Washes Special Area of Conservation (SAC) Site Code: UK0030222. European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Natura 2000, 1 – 12.

permit the Nene Washes designated sites will be exposed to elevated phosphate concentrations that risk waterbodies present in the designated site exceeding that 0.1 mg/L $^{-1}$ annual mean attribute target.

Due to the high background concentrations of orthophosphate, and the significant flow reduction in this reach, the risk of deterioration to orthophosphate during drought plan implementation is considered major in summer and major in winter in both Reach 1 (from Wansford abstraction intake to Orton) and 2 (from Orton to the Tidal Limit at Dog-in-a-Doublet). Therefore, there is potential for adverse effects on qualifying features of the Nene Washes SAC, SPA and Ramsar site in relation to orthophosphate concentrations.

Within the supplementary advice for the Nene Washes SAC, dissolved oxygen saturation, ammonia and biochemical oxygen demand have an attribute target that should be the equivalent to Class 'C' of the Environment Agencies General Quality Assessment scheme (GQA). All of the abiotic parameters are within the Class 'C' thresholds at present at Morton's Leam, however, dissolved oxygen saturation is marginally within the 60% (10%ile) threshold. The risk of deterioration to dissolved oxygen saturation during drought permit implementation is considered major in summer and moderate in winter. Therefore, there is a risk of dissolved oxygen saturation declining below the 60% threshold for Class 'C' GQA, particularly during the summer for the Nene Washes SAC.

Within the supplementary advice for the Nene Washes SPA, dissolved oxygen saturation, ammonia, biochemical oxygen demand and pH must be within the WFD 'Good' EQS thresholds. Biochemical oxygen demand is currently exceeding the WFD 'Good' EQS thresholds and dissolved oxygen saturation is similarly marginally above the 60% threshold. Therefore, adverse effects on qualifying species of the Nene Washes SAC, SPA and Ramsar site cannot be ruled out at this stage in relation to dissolved oxygen saturation and biochemical oxygen demand.

Table 5.5: Baseline water quality Water Framework Directive Environmental Quality Standards assessment for 2010 – 2020.

	Determinant:	DO Saturation (10%ile)	BOD (90%ile)	Ammonia (90%ile)	pH (5-95%ile)	Orthophosphate (AA*)
	Units:	**%**	**mg/l**	**mg/l**	**pH**	**mg/l**
	WFD Good EQS:	**60**	**5**	**0.6**	**6-9**	**0.120**
Environment Agency Monitoring Locations	Peterborough Town Bridge	80.85	6.88	0.12	7.8 - 8.67	0.15
	Dog in a Doublet Sluice	82.80	4.67	0.19	7.86 - 8.69	0.15
	Moreton's Leam	60.43	5.3	0.31	7.54 - 8.49	0.09

Source: The Environment Agency open source data. * AA: Annual average.

	Compliant with EQS
	Non-compliant with EQS

5.2.1.4 Suspended sediment/ siltation

There is the possibility of adverse effects on the Nene Washes SAC, SPA and Ramsar due to increased fine sediment deposition, particularly when the Stanground Sluice is fully open during the summer. In Reach 2 (upstream of the Nene Washes), during the summer and winter, major reductions in flow are likely to increase fine sediment deposition and therefore, have a major impact upon the natural morphological regime of the Reach. Therefore, potential adverse effects as a result of increased siltation cannot be ruled out at this stage on the Nene Washes SAC, SPA and Ramsar site.

5.2.1.5 Potential adverse effects on the qualifying features of the Nene Washes designated sites

Qualifying bird species of Nene Washes SPA and Ramsar site

The key risk from elevated orthophosphate concentrations within the boundaries of the SPA and Ramsar site is that it will promote algal growth and subsequently deplete oxygen levels, as the rate of microbial remineralisation increases to account for the increase in organic matter. For qualifying breeding and wintering bird species, elevated orthophosphate concentrations could impact on the structure and function of the wetland as excessive algal growth will deplete resources, constraining the spatial distribution and diversity of aquatic macrophytes and emergent plants present. This will impact on the availability of suitable breeding, feeding and roosting habitat. The maintenance of macrophytes, marshes and associated invertebrate abundance and diversity, is vitally important for successful breeding, adult fitness and survival. In addition, increased fine sediment deposition particularly during the summer (when Stanground Sluice is fully open) could impact on macrophyte growth.

Spined loach: Qualifying feature of the Nene Washes SAC

A key threat to spined loach in the Nene Washes SAC is water pollution and a review of water quality in Morton's Leam and associated ditches is required as part of the Site Improvement Plan. Due to exposure of Morton's Leam to elevated orthophosphate concentrations, the drought permit has the potential to result in benthic algal growth within the channels, on the substrates that support the spined loach. This could lead to increased levels of siltation which in the short term could produce sub-optimal feeding conditions for spined loach and in the long-term, cause declines in the abundance and composition of macrophytes that spined loach use for shelter and spawning[87]. Furthermore, eutrophication of waterbodies can lead to a build-up of sediment oxygen demand and excessive microbial populations. Spined loach requires well oxygenated, fine sediments to feed and spawn. Therefore, increased biochemical oxygen demand and the resultant reduced oxygen, can lead to physical stress and mortality of adult spined loach, and increased egg and juvenile mortality.

Aquatic macrophytes and invertebrates associated with the Nene Washes Ramsar site

The Ramsar site supports a range of rich flora and nationally scarce plants including fringed water-lily, hair-like pondweed and marsh dock and two rare British Red Data Book invertebrate species. The drought permit has potential to result in elevated levels of eutrophication, algal blooms and increased level of pollutants, such as orthophosphates within the Nene Washes Ramsar site. If sustained over a prolonged period, this could lead to changes in community structure of aquatic macrophytes, while algal blooms could result in choking of segments. In addition, there is potential for increases in fine sediment deposition to adversely affect submerged macrophyte abundance and composition. Such changes in water quality would likely lead to a deterioration of supporting habitats and mortality to macroinvertebrate communities.

5.2.1.6 Proposed Mitigation Measures

We acknowledge the potential for adverse effects on the SAC, SPA and Ramsar sites and will undertake further assessment to better understand the risk of the impact of the drought option on water quality.

Potential mitigation measures are available to prevent the possible adverse effects due to water quality deterioration. This includes the secondary and or tertiary treatment of wastewater discharges into the Nene at Wansford or Wittering Brook. This additional treatment would involve phosphate stripping and aeration of discharged wastewater that is currently elevating orthophosphate levels in the River Nene and increasing the biochemical oxygen demand.

Further assessment of the potential mitigation measures is required (potentially through further SAGIS modelling) to consider the current quality of the wastewater being discharged, the extent of the improvements via additional treatment and the impact on water quality concerns during implementation of the drought permit.

We will share the assessment results with the Environment Agency and Natural England and will liaise with the teams to determine appropriate mitigation measures in the event of requiring the permit.

[87] Natural England (2019). European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Nene Washes Special Area of Conservation (SAC) Site Code: UK0030222. Natura 2000, 1-12.

5.2.1.7 Summary

The Appropriate Assessment has concluded that with the implementation of proposed mitigation measures, the drought permit will not result in adverse effects on the Nene Washes SAC, SPA and Ramsar site. Further detail of the proposed mitigation measures in **Section 5.2.1.6** is required to support the conclusion of no adverse effect on site integrity. This work will be scoped with NE and the EA. The completed work will be provided to relevant regulators prior to drought permit implementation.

A monitoring and mitigation approach has also been devised for baseline, pre-drought actions, during drought and post drought (see **Table 5.6** below for monitoring and mitigation measures in accordance with relevant attributes of the Conservation Objectives for qualifying features of the Nene Washes designated sites). This monitoring plan has been developed based on discussions held with the Environment Agency for DP19, and in line with the DPG 2020. In addition, it is noted that periodic desilting is already required within Moreton's Leam to maintain suitable substrate for spined loach. Therefore, a review of current site management is required to determine the frequency of desilting and if this would prevent adverse effects from this drought option.

Table 5.6: Potential adverse effects on Nene Washes SAC, SPA and Ramsar site qualifying features in accordance with relevant attributes of the Conservation Objectives and monitoring and mitigation requirements.

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
Spined loach	Cover of submerged macrophytes	- Potential increases in orthophosphate concentrations within the Nene Washes could promote algal growth and cause eutrophication. The consequent increase in organic matter remineralisation could lead to reductions in dissolved oxygen and light availability within the water column. Therefore, this could impact on the cover of submerged macrophytes leading to spined loach habitat loss.	**Baseline measures (ongoing):** - Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application. - Initiation/continue campaigns to reduce the distribution input in the surrounding area. - Water quality monitoring upstream of Wansford to establish possible phosphate issues upstream of the intake. - Water quality monitoring upstream of statutory designated sites to establish possible phosphate issues upstream of the intake. **Pre-drought measures (commence immediately before a drought):** - Biological monitoring of macroinvertebrates, macrophytes, fish, water quality and siltation to ensure accurate baseline of conditions. - Contact all licensed abstractors within the potentially affected reach. - Regular liaison with the Environment Agency. **During drought measures (commence in drought period as/if needed):** - Frequently monitor flow against temporary drought permit (minimum residual flow) MRF and cease abstraction at Wansford if flows drop below MRF. - Enhanced monitoring of water quality and biological community to quantify the immediate impact of the drought and the response of the biological community in the recovery period, including additional water quality monitoring upstream of Wansford. - Records of daily abstraction quantities and flow should be submitted to the Environment Agency every week, as well as an updated reservoir storage projection for Rutland Water. The Environment Agency should be informed if water levels in Rutland Water return to the normal operating curve.
	Water quantity/ quality	- Reductions in water flow are compliant with attribute thresholds associated with the Nene Washes SAC and therefore, no adverse effects as a result of flow reduction are anticipated. - As orthophosphate concentrations are already high in the waterbody, this drought permit could exacerbate current water quality concerns.	
	Conservation measures	- This drought option could cause deterioration in water quality within the Nene Washes by reducing the dilution of pollutants; going against the site improvement plan. It is important that a review of water quality in Mortons Leam and ditches is undertaken to gain an understanding of current conditions.	
	Population size	- Promotion of algal growth and the consequent increase in organic matter remineralization could create dissolved oxygen concentration sags at the sediment-water interface and potentially lead to increased egg and juvenile spined loach mortalities. This could have long term impacts on population size.	
	Juvenile densities	- Promotion of algal growth and the consequent increase in organic matter remineralization could create dissolved oxygen concentration sags at the sediment-water interface and potentially lead to increased egg and juvenile spined loach mortalities. This could have long term impacts on juvenile densities within the Nene Washes SAC.	

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
	Flow regime	- Water levels in the Nene Washes are maintained by inundation, which is controlled by a WLMP and flows from the River Nene enter the Nene Washes and Moreton's Leam via Stanground Sluice. - Reductions in water flow are compliant with attribute thresholds associated with the Nene Washes SAC and therefore, no adverse effects as a result of flow reduction are anticipated.	**Mitigation measures (commence on implementation of drought permit):** - Variable abstraction at Wansford during one or two 'spate' flow events to flush pollutants and prevent stagnation. - Reduce abstraction during busy navigation periods. Also consider dredging, de-silting or weed clearing at known problem locations on the main navigation channel. - Review Anglian Water Services (AWS) planned preventative maintenance to ensure that if a storm occurs after long dry periods the sewage infrastructure does not block and cause overspill to the river. - Cessation rules should be in place to halt abstraction if water quality deteriorates below acceptable levels, or if water levels are affected more than currently predicted. - Continuous flow dissolved oxygen (DO) and other parameter (e.g. temperate, pH, conductivity) monitoring and cessation of abstraction if levels fall below a critical value for fish health or if levels are impacted more than predicted. **Post drought measures (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. Periodic desilting is already required within Moreton's Leam to maintain suitable substrate for spined loach. Therefore, a review of current site management is required to determine the frequency of desilting and if this would prevent adverse effects from this drought option.
	Sediment regime	- Reductions in flow, particularly during the summer when Stanground Sluice is kept open could cause an increase in siltation within the Nene Washes -	
Waterfowl and wader assemblage	Water quality/ quantity	- Potential increases in orthophosphate concentrations within the Nene Washes could promote algal growth and cause eutrophication. The consequent increase in organic matter remineralisation could lead to reductions in dissolved oxygen and light availability within the water column. Therefore, this could impact on the cover of submerged macrophytes	**Baseline measures (ongoing):** - Frequent monitoring of flow data during periods of low flow to identify the trigger for initiating a drought permit application. - Initiation/continue campaigns to reduce the distribution input in the surrounding area.

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
		leading to reductions in food availability for bird populations within the Nene Washes SPA and Ramsar site.	- Water quality monitoring upstream of Wansford to establish possible phosphate issues upstream of the intake. - Water quality monitoring upstream of statutory designated sites to establish possible phosphate issues upstream of the intake. **Pre-drought measures (commence immediately before a drought):** - Biological monitoring of macroinvertebrates, macrophytes, water quality and siltation to ensure accurate baseline of conditions. - Contact all licensed abstractors within the potentially affected reach. - Regular liaison with the Environment Agency. **During drought measures (commence in drought period):** - Frequently monitor flow against temporary drought permit MRF and cease abstraction at Wansford if flows drop below MRF. - Enhanced monitoring of water quality and biological community to quantify the immediate impact of the drought and the response of the biological community in the recovery period, including additional water quality monitoring upstream of Wansford. - Records of daily abstraction quantities and flow should be submitted to the Environment Agency every week, as well as an updated reservoir storage projection for Rutland Water. The Environment Agency should be informed if water levels in Rutland Water return to the normal operating curve. **Mitigation measures (commence on implementation of drought permit as/if needed):** - Variable abstraction at Wansford during one or two 'spate' flow events to flush pollutants and prevent stagnation. - Reduce abstraction during busy navigation periods. Also consider dredging, de-silting or weed clearing at known problem locations on the main navigation channel. - Review AWS planned preventative maintenance to ensure that if a storm occurs after long dry periods the sewage infrastructure does not block and cause overspill to the river.
	Food availability within supporting habitat	- Eutrophication could compromise food availability for bird populations of the Nene Washes SPA and Ramsar site by causing deterioration in the cover of submerged macrophytes and associated invertebrates.	
	Conservation measures	- Hydrological changes in the Nene washes is a key threat to qualifying bird species. Water levels in the Nene Washes are maintained by inundation, which is controlled by a WLMP and flows from the River Nene enter the Nene Washes and Moreton's Leam via Stanground Sluice.	
	Population abundance	- Reductions in food availability in the Nene Washes due to deteriorations in water quality from reduced water flows could cause a decline in the carrying capacity of site, reducing the population abundance.	
	Hydrology/ flow	- Water levels in the Nene Washes are maintained by inundation, which is controlled by a WLMP and flows from the River Nene enter the Nene Washes and Moreton's Leam via Stanground Sluice.	
	Water area/ depth	Water levels in the Nene Washes are maintained by inundation, which is controlled by a WLMP and flows from the River Nene enter the Nene Washes and Moreton's Leam via Stanground Sluice. Although flow and water levels in the River Nene downstream of Wansford intake are expected to decrease under drought permit conditions, structural controls on the Nene Washes mean that this impact will not be replicated within the designated site.	

Qualifying feature	Attribute	Adverse effect?	Monitoring and Mitigation
			- Cessation rules should be in place to halt abstraction if water quality deteriorates below acceptable levels, or if water levels are affected more than currently predicted. - Continuous flow DO and other parameter (e.g. temperate, pH, conductivity) monitoring and cessation of abstraction if levels fall below a critical value for fish health or if levels are impacted more than predicted. **Post drought measures (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.

5.2.2 Rutland Water SPA and Ramsar site

5.2.2.1 Overview

Table 5.7 provides a summary of the potential adverse effects of the proposed drought permit on Rutland Water SPA and Ramsar site.

Table 5.7: Potential adverse effects of the River Nene (Wansford Intake/ Rutland Water) drought permit on the Rutland Water SPA and Ramsar site.

Impact	Details
Water quality	In 2019, phosphate concentrations in the River Nene at Islip to tidal (GB105032050381) were classified as poor[88]. Under drought conditions, it is anticipated that nutrient concentrations (phosphate in particular) of the abstracted water will be high. In supplementary advice for Rutland Water SPA, it suggests that meeting the surface water environmental standards set out by the WFD will be sufficient to support the SPA Conservation Objectives. Based on water quality data collected at Hambleton South Shore, Rutland Water in 2019 – 2020, total phosphorus concentrations were above the WFD EQS threshold for moderate alkalinity, deep waterbodies (mean phosphorus of 0.082 mg/l, annual mean threshold is 0.012 mg/l). In addition, the final effluent from Oakham Treatment Works shows that the annual mean phosphorus concentrations were 0.069mg/l, which is also above the annual mean threshold provided in the supplementary advice for Rutland Water SPA. Although it is anticipated that excess orthophosphate will be assimilated by perennial macrophytes in the system (e.g. *Potamogeton* species), there is uncertainty whether discharged water into Rutland Water will be within the specific WFD good EQS thresholds for moderate alkalinity, deep waterbodies.
Habitat loss	Elevated nutrient concentrations (particularly phosphate and nitrates) could lead to significant blue-green algal blooms and negative impacts on macrophyte community assemblage, abundance and distribution which support qualifying bird species as a food source. This is a known pressure on the system, in lagoons 2 and 3.

5.2.2.2 Potential adverse effects on the qualifying species of Rutland Water designated sites

As the qualifying bird species of Rutland Water are designated as non-breeding populations, exposure to poor water quality as a result of discharged water from the River Nene will impact on the feeding and roosting habitats relied upon during the winter. As dabbling ducks, gadwall for example require shallow foraging habitat at the periphery of the reservoir (particularly in the secluded western inflow areas in the north and south arms) to feed on grasses, rushes, sedges, pondweed and water milfoil[89]. Northern shoveler are similarly shallow feeders, relying on wetlands, lowland marshes and open water bodies to feed on aquatic invertebrates, sedges, rushes, pondweeds and duckweeds. In Rutland Water SPA they are often recorded in Burley Fishponds, Heron Bay, Manton Bay and Lagoons 1, 2 and 3[90]. From 2019 – 2020, based on WeBs peak counts, bird populations at Rutland Water were exceeding national and international importance thresholds for some species. For example, gadwall was exceeding the international importance thresholds and coot, goldeneye, great crested grebe, northern shoveler and tufted duck were exceeding the national importance thresholds at Rutland Water. It is noted that Rutland Water SSSI underpinning Rutland Water SPA is currently in favourable condition based on assessments in 2021.

However, the site is currently exceeding the annual mean phosphorus threshold for moderate alkalinity, deep waterbodies of 0.012 mg/l. This could be having an impact on other qualifying bird species such as goosander, mute swan, teal and wigeon. For example, Eurasian teal peak bird count from 2019 – 2020 was 580 in comparison to 1,942 the previous year[91]. Phosphate concentrations in the River Nene are currently above the WFD 'Good' EQS threshold by 0.03 mg/l. Therefore, implementation of the proposed drought permit will expose Rutland Water to water supply that has higher phosphate

[88] Environment Agency (2019). Nene – Islip to tidal. Catchment Data Explorer. Accessed from: Environment Agency - CDE - Nene - Islip to tidal (data.gov.uk)
[89] Natural England (2018). Rutland Water Special Protection Area (SPA), Site code: UK9008051. European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Natura 2000, 1 – 16.
[90] Natural England (2018). Rutland Water Special Protection Area (SPA), Site code: UK9008051. European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Natura 2000, 1 – 16.
[91] Frost, T.M., Calbrade, N.A., Birtles, G.A., Hall, C., Robinson, A.E., Wotton, S.R., Balmer, D.E. and Austin, G.E. 2021. *Waterbirds in the UK 2019/20: The Wetland Bird Survey*. BTO/RSPB/JNCC. Thetford.

concentrations, which will cause conditions to further deteriorate and exceed the WFD 'Good' EQS threshold for moderate alkalinity, deep waterbodies. This could cause excessive algal growth, increasing the biochemical oxygen demand within Rutland Water and reducing the suitability of the site to support a high diversity of aquatic vegetation and associated invertebrates. This would not be compliant with the sites Conservation Objectives and mitigation measures are required in order to conclude no adverse effect on qualifying bird populations.

5.2.2.3 Proposed Mitigation Measures

The abstracted water from the River Nene at Wansford Intake must be pre-treated, in order to reduce phosphorus concentrations to < 0.012 mg/l before discharge into Rutland Water. This will ensure that the drought permit is compliant with the Conservation Objectives for the site and will prevent future deterioration from favourable conservation status. Details on the method of pre-treatment and installation design must be agreed with the relevant regulators prior to the implementation of the drought permit.

5.2.2.4 Summary

On the basis that discharged water into Rutland Water will be pre-treated to ensure it is compliant with WFD 'Good' EQS thresholds for moderate alkalinity, deep waterbodies, no adverse effects on qualifying bird species of Rutland Water SPA and Ramsar site are anticipated. See **Table 5.6** for detail on additional monitoring and mitigation measures associated with the River Nene (Wansford Intake/ Rutland Water) drought permit.

5.3 River Wensum (Costessey groundwater sources) drought permit

5.3.1 Overview

Table 5.8 below provides a summary of the potential adverse effects of the proposed drought permit on the River Wensum SAC. See Section 4.4 and 4.5 of the River Wensum (Costessey Boreholes) Drought Permit EAR for more detail on the geomorphological and water quality assessments. Note that the EAR hydrological assessment is based on comparison of the drought permit implementation and denaturalised flows. The Stage 2 Appropriate Assessment of the River Wensum (Costessey groundwater sources) drought permit considered implementation of the drought permit in comparison to naturalised flows, in accordance with the supplementary advice.

Table 5.8: Potential adverse effects of the River Wensum (Costessey groundwater sources) drought permit on the River Wensum SAC.

Impact	Details
Flow regime	Hydrological impact assessments of the River Wensum have concluded that during annual Q_{99} in Reach 1 (Morton to Costessey intake, 5.6km, SSSI units 53 and 54) the drought permit will result in a 5.2% reduction in river flow, in comparison to naturalised flows. In Reach 2 (Costessey intake to River Tud confluence, 11km, SSSI unit 54), during annual Q_{99} the drought permit will result in a 9.1% reduction in river flow, in comparison to naturalised flows. In Reach 3 (River Tud confluence to River Yare confluence, 14.1km, SSSI unit 54), during annual Q_{99} the drought permit will result in a 11% reduction in river flow, in comparison to naturalised flows. The anticipated impacts on the flow regime of Reach 1 and 2 are compliant with the water course qualifying feature flow attribute targets within the Conservation Objectives; this is based on the low flows (Q_{99}) limit of 10% deviation from naturalised flows. However, the flow regime in Reach 3 is anticipated to exceed the 10% threshold during annual Q_{99} and therefore, the drought permit would not be compliant with the Conservation Objectives of the designated site.
Groundwater	At maximum, an additional drawdown of 4 – 5m in comparison to baseline groundwater levels was modelled considering the worst-case scenario, during operation of the drought permit. Water level monitoring has found that the groundwater levels in the adjacent land parcels are strongly correlated with levels in the River Wensum, indicating a direct hydrological link between the groundwater levels and river levels. This could impact on the availability of wetted habitat required for Desmoulin's whorl snail, with SSSI units 38 and 39 exposed to an estimated additional drawdown of 2 – 3m.
Water quality	Water quality deterioration in the River Wensum could occur due to reduced flows (particularly in Reach 2 during the summer and Reach 3 throughout the year) and therefore, a reduction in the dilution of contaminants leaching into the system. Increased nutrient concentrations (particularly phosphate) in combination with reduced flows, could cause excessive algal growth, detrimental to the functioning of the river and the integrity of the SAC. The annual average orthophosphate concentrations at Taverham Bridge monitoring station (2010 – 2020) was 0.07 mg/l. Although this is within the WFD 'Good' Environmental Quality Standards (EQS) threshold, the site is currently above the attribute target of 0.03 mg/l by 2027 (interim goal of 0.05 mg/l by 2021) for the nutrients attribute. With the implementation of the drought permit and anticipated minor changes in flow regime, it is likely that nutrient concentrations during operation will increase in the River Wensum and further exceed the target for soluble reactive phosphorus. This could impact on all of the qualifying features of the SAC and associated supporting habitat. Dissolved oxygen saturation in the River Wensum at Taverham Bridge monitoring station (2010 – 2020) was 81.48 (10%ile) which is within favourable conditions for white clawed crayfish, which require >70% oxygen saturation. However, dissolved oxygen saturation remains slightly below the attribute target of 85% saturation for the water course with floating vegetation dominated by water-crowfoot. Negligible impacts to dissolved oxygen saturation is anticipated across Reach 1, 2 and 3 based on the water quality assessment (noted that WFD 'Good' EQS values are used).
Habitat loss	The main mechanism for habitat loss in the River Wensum is indirectly through the occurrence of other potential impacts such as alterations to water levels and flow which can cause flooding/ drought conditions, water quality deterioration resulting in excessive algal growth and dissolved oxygen sags or smothering by an increase in sediment deposition.

The LSEs on qualifying features of the River Wensum SAC arising from the proposed drought permit have been identified in the HRA Stage 1 Screening assessment. Each qualifying feature identified in the screening assessment as susceptible to changes in the hydrological flow regime, groundwater levels, water quality deterioration, increased siltation and the resultant habitat loss is discussed below.

5.3.2 Potential adverse effects on the qualifying features of the River Wensum SAC

5.3.2.1 Water courses with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

Water quantity and the resultant extent of inundation of macrophyte communities, plus the seasonal timing of changes in supply, are key factors influencing the development and stability of *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation[92]. The dynamic nature of riverine environments requires associated species to constantly adapt to fluctuations in flow regime and sediment load, leading to changes in fluvial processes and associated habitats. The optimum flow rate for *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation is between 0.3 and 0.5m/s[93]. High flow rates and flushes associated with increased rainfall in autumn are vitally important for Ranunculaceae species, as it removes excess sediment deposited during the summer, for the growing season. The growth of *Ranunculus penicillatus* subsp. *pseudofluitans* for example, has coincided with maximum flow in chalk streams[92]. In addition, *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation supports a diversity of community assemblages including diatoms, macroinvertebrates and fish. Therefore, deterioration of macrophytes will have a direct impact on associated species and the structure and function of the riverine system.

SSSI unit 53 and 54 that are present in Reach 2 and Reach 3 of the River Wensum are both in unfavourable – no change condition. This is due to the hydrological, water quality and sediment regime targets not being met. In unit 53, the channel is over widened and deep with the left bank extensively poached and grazed and high silt deposition is evident. As a result, small discrete patches of *Ranunculus* species are present. In unit 54, the channel downstream of Costessey Mill is fast flowing and more natural in form and function. This has resulted in greater diversity in channel vegetation with *Ranunculus penicillatus* subsp. *pseudofluitans*, *Butomus umbellatus* and *Fontinalis antipyretica* present. In Reach 3, an 11% reduction in flow regime is anticipated during annual Q_{99}. This exceeds the 10% low flow attribute target in the supplementary advice for the River Wensum SAC. Therefore, there is potential for adverse effects on water courses with *Ranunculion fluitantis* and *Calitricho-Batrachion* vegetation, in relation to flushing flows, that are vitally important for successful macrophyte growth in the summer.

In relation to water quality, Wensum US Norwich (GB105034055881) overall classification status for 2019 was moderate and the physcio-chemical status was good[94]. Concentrations of phosphate, ammonia, dissolved oxygen and pH were all compliant with their respective EQS, all achieving high status. **Table 5.9** below presents the 10-year averages (2010 – 2020) of various water quality parameters for the River Wensum. Note that only one monitoring site had suitable data for further analysis during this timeframe.

[92] Hatton-Ellis T.W and Grieve, N. (2003). Ecology of Watercourses Characterised by Ranunculion fluitantis and Callitricho-Batrachion Vegetation. Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.
[93] [93] Environment Agency (2004). *Ranunculus* in Chalk rivers: Phase 2. Science Report W1-042/TR.
[94] Environment Agency (2019) Wensum US Norwich Overview. Catchment Data Explorer. Accessed from: https://environment.data.gov.uk/catchment-planning/WaterBody/GB105034055881

Table 5.9: Baseline water quality Water Framework Directive Environmental Quality Standards assessment for 2010 – 2020.

	Determinant:	DO Saturation (10%ile)	BOD (90%ile)	Ammonia (90%ile)	pH (5-95%ile)	Orthophosphate (AA*)
	Units:	**%**	**mg/l**	**mg/l**	**pH**	**mg/l**
	WFD 'Good' EQS:	**60**	**5**	**0.6**	**6-9**	**0.12**
Environment Agency Monitoring Locations	Taverham Bridge	81.48	1.44	0.05	7.55 – 8.27	0.07
	Costessey Pit NO1	N/A	N/A	N/A	N/A	N/A
	Costessey Pit NO2	N/A	N/A	N/A	N/A	N/A
	Costessey Mill	N/A	N/A	N/A	N/A	N/A

Source: The Environment Agency open source data. *DO: Dissolved oxygen. AA: Annual average.

	Compliant with EQS
N/A	No/insufficient data available

At Taverham monitoring site dissolved oxygen saturation, biochemical oxygen demand, ammonia, pH and orthophosphate were within the WFD 'Good' EQS. Overall, changes in orthophosphate have been assessed as minor in summer and negligible in winter in relation to WFD 'Good' EQS (see Section 4.5 DP22 River Wensum (Costessey Boreholes) EAR). However, the site specific soluble reactive phosphorus targets for the main river below Sculthorpe is 0.03 mg/l, with an interim target of 0.05 mg/l[95]. Therefore, the River Wensum SAC is currently not compliant with its Conservation Objectives. This is largely due to phosphate pollution from agricultural practices and sewage treatment works. During operation of the proposed drought permit, phosphorus concentrations are likely to increase during the summer in Reach 2 and throughout the year in Reach 3. Elevated nutrient concentrations that are not compliant with the Conservation Objectives could lead to excessive algal growth and loss of characteristic higher plant species. Large growths of benthic of floating algae could also cause diurnal sags in dissolved oxygen, creating poor substrate conditions for fish and aquatic invertebrates.

In addition, overall changes in dissolved oxygen have been assessed as negligible in relation to WFD 'Good' EQS. Dissolved oxygen saturation from 2010 – 2020 (10%ile) was 81.48% which is slightly below the attribute target of 85% saturation for the water course with floating vegetation dominated by water-crowfoot. In isolation, no adverse effects from the drought permit are anticipated on dissolved oxygen saturation in the River Wensum. However, the potential for increased phosphorus concentrations to cause diurnal sags in dissolved oxygen has been identified.

Appropriate mitigation measures must be determined in order to conclude no adverse effect as the drought permit has the potential to further prevent the River Wensum SAC meeting its Conservation Objectives and favourable conservation status for Water courses with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

5.3.2.2 White-clawed crayfish

In unit 53 of the River Wensum SSSI, white-clawed crayfish are in unfavourable condition due to the presence of signal crayfish *Pacifastacus leniusculus*. Reductions in flow regime, particularly in Reach 3 could increase the predation risk of white-clawed crayfish. White-clawed crayfish are also sensitive to changes in ammonia, pH, total nitrogen, dissolved oxygen saturation and water temperature. Dissolved oxygen saturation in the River Wensum at Taverham Bridge monitoring station (2010 – 2020) was 81.48 (10%ile) which is within favourable conditions for white clawed crayfish, which require >70%

[95] Natural England (2019). River Wensum Special Area of Conservation (SAC). Site code: UK0012647. European Site Conservation Objectives: Supplementary advice on conserving and restoring site features. 1 – 56.

oxygen saturation. Overall changes in dissolved oxygen have been assessed as negligible in relation to WFD 'Good' EQS. In addition, ammonia concentrations (90%ile) were 0.05mg/l which is within favourable conditions for white-clawed crayfish, which require >0.6mg/l. Water quality assessments have concluded that negligible impacts on total ammonia concentrations are anticipated in Reach 1, 2 and 3.

The upper lethal limit for white-clawed crayfish is 30°C, with high mortality rates recorded >28°C in one study. Based on available data, the maximum temperatures in Reach 1 and Reach 2 range from 20.2 – 21.4°C. As no adverse effects on the hydrological regime are anticipated from the proposed drought permit, water temperatures are unlikely to increase to an extent that would impact on white-clawed crayfish populations. Similarly, pH is also within WFD 'Good' EQS thresholds and based on the water pH attribute targets for white-clawed crayfish is within the 6.5 – 9 range. As no adverse effects on the hydrological regime are anticipated from the proposed drought permit, pH is unlikely to increase to an extent that would impact on white-clawed crayfish populations.

However, particularly in Reach 2 during the summer and Reach 3 throughout the year (SSSI unit 54), the potential increase in phosphorus concentrations could have an indirect impact on dissolved oxygen saturation. As water quality thresholds required to meet attribute targets for water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation are sufficient for white-clawed crayfish, there are potential adverse effects on phosphorus concentrations. Therefore, appropriate mitigation measures must be determined in order to conclude no adverse effects on white-clawed crayfish.

5.3.2.3 Desmoulins's whorl snail

Desmoulin's whorl snail distribution and abundance are closely linked to groundwater levels and associated ground moisture. It is not anticipated that changes in water quality in the River Wensum will impact on peripheral fen, marsh and swamp communities, as the drought permit will be implemented during low flows (not during flood events). Therefore, the following assessment focused on groundwater levels and the potential adverse effects on Desmoulin's whorl snail populations and supporting habitat. Killen (2003)[96] defined population levels against a hydrological gradient outlined in **Table 5.10**. High populations occurred where water levels were always above ground level. In contrast where water levels dropped below 0.4mbgl the snail occurred only at very low abundances.

Table 5.10: Summary of the hydrological requirements of Desmoulin's whorl snail.

Desmoulin's whorl snail	Associated water level
High population	Mean annual water level over +0.25m, with fluctuations from 0m to +0.6m Water level never/very rarely falls below ground level
Medium population	Water level fluctuates between -0.2m and +0.2m during the year
Low population	Mean annual water level less than 0m, with fluctuations from -0.4m to 0m
Critical population	Minimum: Summer -0.5m below ground level Winter -0.4m below ground level

Source: Mott MacDonald (adapted from Kileen, (2003))[97]

SSSI Units 38 -39

The proposed drought permit at Costessey groundwater sources was conceptualised using the Costessey sub-model, which is based on the Environment Agency's North East Anglian Chalk regional

[96] Killeen (2003). *Ecology of Desmoulin's Whorl Snail*. Conserving Natura 2000 Rivers Ecology Series No. 6. 1-27.
[97] Kileen, I. J. (2003). Ecology of Desmoulin's Whorl Snail. Conserving Natura 2000 Rivers Ecology Series No. 6. England Nature, Peterborough.

model constructed by Wood PLC (previously Amec Foster Wheeler) for SSSI units 38 and 39 respectively.

Three abstraction scenarios were modelled for a period of severe drought (1991, which was the third of three years of below average summer flows in the River Wensum) and compared with a no abstraction baseline scenario (**Figure 5.1**). The groundwater abstraction scenarios were:

- Scenario 1: groundwater abstraction from borehole No. 3 at a continuous rate of 3.5Ml/day;
- Scenario 2: continuous groundwater abstraction of 3.5Ml/day from borehole No. 3 and 100 days of abstraction between July and October 1991 at 20.5Ml/day from borehole No. 2; and
- Scenario 3: a continuous groundwater abstraction of 3.5Ml/day from borehole No. 3 and 200 days of abstraction between April and November 1991 at 20.5Ml/day from borehole No. 2.

The three scenarios represent annual abstraction figures of 1278, 3328 and 5378Ml respectively. Scenario 3 is a little more severe than the proposed drought permit which would involve annual abstraction of up to 4800Ml.

Examination of the simulated scenarios against the baseline groundwater levels for SSSI units 38 and 39 suggest that water levels are below the requirements of Desmoulin's whorl snail. Under Scenario 3 the water levels drop to a minimum of approximately 2.5m below baseline conditions in the summer, with waters under Scenario 2 following a similar trend. Groundwater fluctuations simulated under Scenario 1 are far less extreme, with water levels staying in the tolerable range of the snail for the majority of the cycle with the exception of a small period a small period in the summer 1991. Scenario 1 does not relate to the current proposed drought permit.

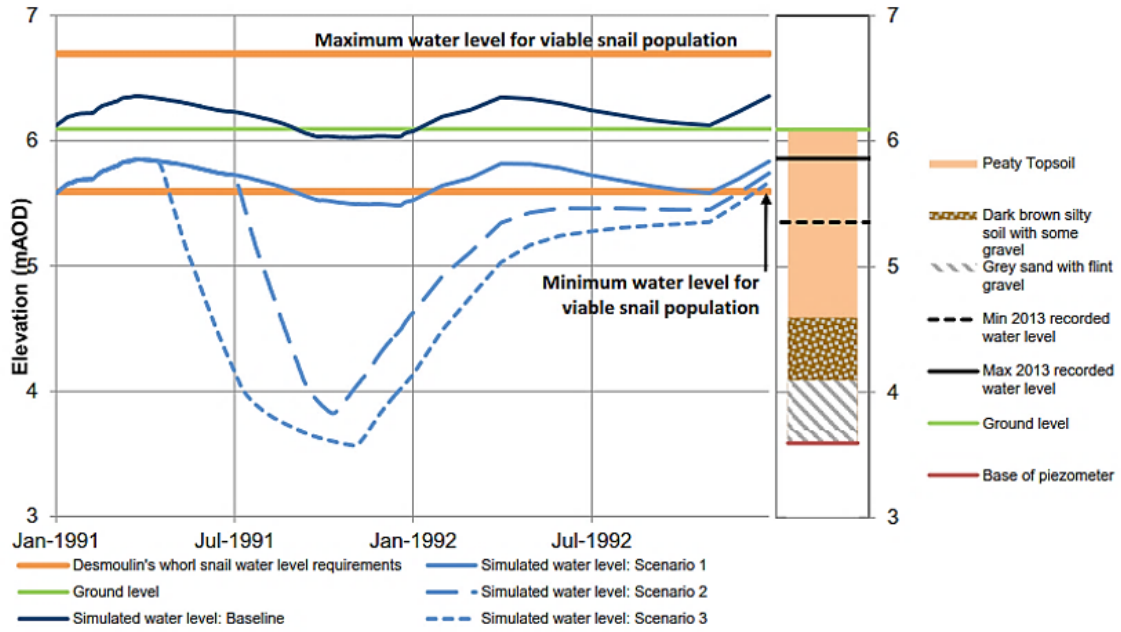

Figure 5.1: Range of simulated and observed water levels compared with the requirements of Desmoulin's whorl snail[98]

It must be noted that the regional model had to be used to estimate the groundwater levels at SSSI units 38 and 39 and information regarding the local hydrodynamics have not been incorporated into the model due to a lack of data.

Piezometer data covering most of the period since 2013 (**Figure 5.2**) shows that the level dropped below 5.5m in every year and was therefore, below the minimum water level for a viable snail population. This was in a period without particularly notable drought conditions and no drought action, such as the proposed drought permit abstraction. Appropriate vegetation management of unit 38 and 39 is currently not in place. Based on condition assessments conducted in 2014, both units were in unfavourable – no change condition. Therefore, the implementation of the proposed drought permit could worsen the condition of the site by further limiting ground moisture which could alter the composition of fen, marsh and swamp vegetation that supports Desmoulin's whorl snail. The implementation of the drought permit would not be compliant with the Conservation Objectives to restore the site to favourable conservation status; as is the aim of the River Wensum Restoration Strategy.

[98] Mott MacDonald (2014) River Wensum: Costessey boreholes. Drought plan environmental assessment

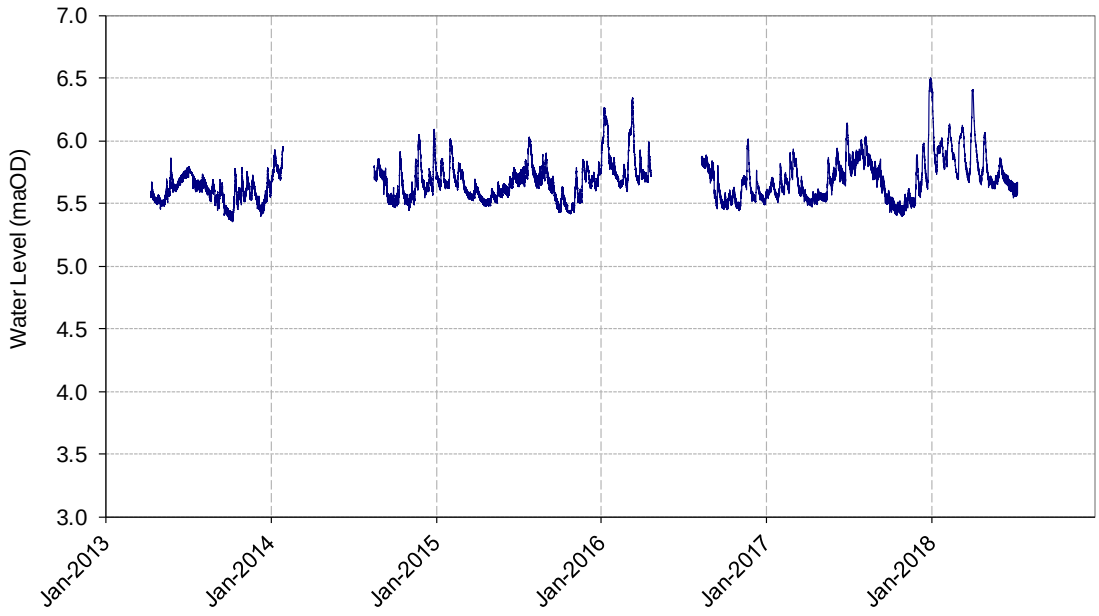

Figure 5.2: Piezometer data for land parcel 38/39.

SSSI Units 40- 44 (Hellesdon Meadows)

River Wensum SSSI units 40 – 44 are in unfavourable – recovering condition and are adjacent to Reach 2 of the environmental assessments. The area of units 40-44 (Hellesdon Meadows) has also been identified as suitable habitat for Desmoulin's whorl snail.

The groundwater predictions in response to the 2013 pump test (**Figure 5.1**) suggested a potential decrease in groundwater levels of 0.1 - 0.5m at Land Parcel 40-44 (Hellesdon Meadows). Therefore, reduced ground moisture could result in habitat deterioration, impacting on the capacity of the site to support Desmoulin's whorl snail populations. Further examination of the impact of the proposed drought permit on Desmoulin's whorl snail is required.

5.3.2.4 Bullhead

Bullhead have been identified both upstream and downstream of the Costessey abstraction point, but these areas are unlikely to be spawning grounds for this species. Bullheads utilise a variety of habitats with variable flow regimes. Juvenile bullheads are associated with shallow, stony riffles where they occupy the interstitial space between the stones for shelter. Adults are associated with shallow to moderate water depths, between 5-40cm and sheltered sections of rivers created by wood debris, macrophyte cover and large stones, particularly during the daytime[99]. Adults have largely been recorded in rivers with moderate velocities (greater than 0.10m/s) and in fast flowing rivers up to 0.40m/s[100]. The small reduction in depth predicted due to the implementation of a drought permit will, therefore, not have an adverse effect on this species. However, a potential reduction in water velocity could have implications for adults downstream of the abstraction point. In the 2014 Mott MacDonald report, the estimated maximum reduction in velocity in 1991 is 0.003m/s, reducing from 0.157m/s in the baseline simulation to 0.154m/s in Scenario 3 (reduction of 2% from the baseline), and therefore reported as minimal. The relationship between velocity and flow for the current proposed drought permit is not fully

[99] Hatton-Ellis, T.W. and Grieve, N (2003). Ecology of Watercourses Characterised by Ranunculion fluitantis and Callitricho-Batrachion Vegetation. Conserving Natura 2000 Rivers Ecology Series No. 11. 1 – 67.[100] Mott MacDonald, 2018. Drought Permit Environmental Assessment. River Wensum (Costessey groundwater sources) September 2018.

understood, however, low flow velocity must be considered in this assessment. Lower flow velocity can result in a reduction in dissolved oxygen concentrations which are unsuitable conditions for bullhead. Potential impact pathways from the proposed drought permit on bullhead are in relation to water quality deterioration, particularly in Reach 2 during the summer and Reach 3 throughout the year (SSSI unit 54). Excess phosphorus may result in an increase in benthic algal growth, reducing the suitability of substrate habitat for bullhead to shelter. This may also have an indirect impact on dissolved oxygen saturation however, there is a lack of information on dissolved oxygen requirements of bullhead and it is not listed as an attribute in the supplementary advice. Therefore, information has been gleaned from brown trout ecology. This is considered appropriate as bullhead and brown trout occur sympatrically and therefore, will have similar dissolved oxygen requirements. Brown trout require a minimum dissolved oxygen concentration of 40% saturation[101]. No adverse effects in relation to dissolved oxygen saturation are anticipated as between 2010 – 2020 dissolved oxygen saturation was 81.48% (10%ile). This is double the minimum requirement for brown trout and is also within the WFD 'Good EQS threshold of 60%. However, there is potential for adverse effects on habitat suitability of the River Wensum due to increases in phosphorus concentrations, that are currently failing water quality attribute targets for the site and reductions in flow anticipated in Reach 3.

5.3.2.5 Brook Lamprey

Potential impact pathways from the proposed drought permit on brook lamprey are in relation to water quality deterioration, particularly in Reach 2 during the summer and Reach 3 throughout the year (SSSI unit 54). Excess phosphorus may result in an increase in benthic algal growth, reducing the suitability of spawning gravels for brook lamprey and silt beds for ammocoetes. This may also have an indirect impact on dissolved oxygen saturation however, there is a lack of information on dissolved oxygen requirements of brook lamprey and it is not listed as an attribute in the supplementary advice. Therefore, information has been gleaned from brown trout ecology. This is considered appropriate as bullhead and brown trout occur sympatrically and therefore, will have similar dissolved oxygen requirements. Brown trout require a minimum dissolved oxygen concentration of 40% saturation[102]. No adverse effects in relation to dissolved oxygen saturation are anticipated as between 2010 – 2020 dissolved oxygen saturation was 81.48% (10%ile). This is double the minimum requirement for brown trout and is also within the WFD 'Good EQS threshold of 60%. However, there is potential for adverse effects on habitat suitability of the River Wensum due to increases in phosphorus concentrations, that are currently failing water quality measures for the site.

Brook lamprey spawn in late spring/ early summer, when temperatures reach between 10-11°C. Typically adults require flow velocities in the region of 0.2-0.3m/s and water depth of 3-30cm. Once the eggs hatch, ammocoete larvae drift downstream, settling in depositing substrates such as silt at river and stream margins. These nursery grounds have slow flow rates and are typically backwaters with flow in reverse compared to the main current[103]. Cowx et al (2004)[104] also provides some optimum depths and velocities that correlate with the above flow rates: larvae <50cm, 0.08-0.10m/s; spawning 3-150cm, 0.3-0.5m/s (**Table 5.11**).

Table 5.11: Summary of the hydrological requirements of brook lamprey

European feature	Optimum depth (m)	Optimum velocity (m/s)
Brook lamprey (Lampetra planeri)	Larval nursery beds: 0.25m Larvae: <0.5m Spawning 0.03-1.5m	Larval nursery beds: 0.4m/s Burrows: 0.08-0.1m/s Larvae: 0.08-0.1m/s Spawning: 0.3-0.5m/s

Source: Cowx et al (2004)

[101] Tomlinson ML & Perrow MR, 2003. Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.
[102] Tomlinson ML & Perrow MR, 2003. Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

The river reach potentially impacted by the drought permit is generally not synonymous with brook lamprey spawning habitat, due the depth of the water column (>5m). However, potential reductions in the volume of water present in the River Wensum during operation of the proposed drought permit could reduce the wetted width of the river, potentially resulting in habitat loss of suitable silt beds for brook lamprey ammocoetes. The reduced flow rates could also cause an increase in the deposition of fine material on optimum habitats in Reach 3.

5.3.3 Summary

In conclusion, there is potential for adverse effects on the qualifying features of the River Wensum SAC due to reductions in groundwater levels that could impact on habitat suitability for Desmoulin's whorl snail, increases in phosphorus concentrations and reductions in water flow in Reach 3. As the site is currently failing to meet its attribute targets for Soluble Reactive Phosphorus, any further increase in concentration as a result of the proposed drought permit (particularly in Reach 2 during the summer and Reach 3 throughout the year) will impact on site integrity and will not be compliant with the Conservation Objectives of the River Wensum SAC. In addition, flow regime in Reach 3 is anticipated to exceed the 10% threshold during annual Q_{99} and therefore, the drought permit would not be compliant with the Conservation Objectives of the designated site.

Further monitoring is required to assess the current condition of the River Wensum SAC and to inform if appropriate mitigation measures can be implemented to conclude no adverse effects for all of the qualifying features of the River Wensum SAC. Following the collection of data and its analysis, the Stage 2 assessment will need to be revisited, to update the outcome and to provide confirmation provided on the appropriate mitigation measures that could reduce the potential for adverse effects.

A summary of the potential adverse effects on qualifying features of the designated site, in accordance with relevant attributes of the Conservation Objectives and monitoring and mitigation previously proposed is provided below in **Table 5.12.** This monitoring plan has been developed based on discussions held with the Environment Agency for DP19, and in line with the DPG 2020.

Table 5.12: Potential adverse effects on River Wensum SAC qualifying features in accordance with relevant attributes of the Conservation Objectives and monitoring and mitigation requirements.

Qualifying feature	Attribute	Adverse effects?	Mitigation and Monitoring
Ranunculion fluitantis and *Callitricho-Batrachion* vegetation	Extent of the feature associated with the site	- Decreases in dilution capacity of nutrients (particularly phosphorus) could have an impact on the extent of this qualifying feature due to excessive algal growth and associated changes in species composition. - When considering river flow, the impact of predicted changes *on Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	**Baseline measures (ongoing):** - River flow and water levels to be recorded at 15-minute intervals. - Investigation into current use of licenced and private abstractions. **Pre-drought measures (commence immediately before a drought):** - Monitoring of macrophytes and water quality to ensure accurate baseline of conditions. - Contact other abstractors. **During drought measures (commence in drought period):** - Enhanced phosphate, dissolved oxygen, ammonia, temperature and turbidity monitoring in River Wensum and Costessey Pits. - Increased macrophyte sampling during the drought permit application and implementation. **Mitigation measures (commence on implementation of drought permit as/if needed):** - Mitigation of derogation through actions such as pump lowering, borehole deepening or compensation at potentially impacted other abstractors. **Post drought measures (commence after drought permit has been lifted):** - Surface water and groundwater quality monitoring will revert back to baseline sampling levels. - Additional ecological monitoring should continue up to three years after the cessation of the drought permit.
	Biotope (habitat mosaic)	- Decreases in dilution capacity of nutrients (particularly phosphorus) could have an impact on the extent of this qualifying feature due to excessive algal growth and associated changes in species composition. - Reductions in flow and subsequent increase in the deposition of fine material (particularly during autumn flushes) and decrease in dilution of nutrients could have an impact on the extent of this qualifying feature. - When considering river flow, the impact of predicted changes *on Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	
	Water course flow	- Flow regime in Reach 3 is anticipated to exceed the 10% threshold during annual Q_{99} and therefore, the drought permit would not be compliant with the Conservation Objectives of the designated site. - Reductions in flow and subsequent increase in the deposition of fine material (particularly during autumn flushes) and decrease in dilution of nutrients could have an impact on the extent of this qualifying feature. - When considering river flow, the impact of predicted changes *on Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	

Qualifying feature	Attribute	Adverse effects?	Mitigation and Monitoring
	Sediment regime	- Reductions in flow and subsequent increase in the deposition of fine material (particularly during autumn flushes) could have an impact on the extent of this qualifying feature as they rely on removal of sediment during high flows in autumn, for successful growth in spring. - When considering river flow, the impact of predicted changes *on Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	
	Key structural, influential and/or distinctive species	- Decreases in dilution capacity of nutrients (particularly phosphorus) could have an impact on the extent of this qualifying feature due to excessive algal growth and associated changes in species composition. - Deterioration of the health and extent of *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation would impact on diatoms, macroinvertebrates and fish that rely on this qualifying habitat for shelter, feeding and spawning. - When considering river flow, the impact of predicted changes *on Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	
	Vegetation structure: cover of submerged macrophytes	- Decreases in dilution capacity of nutrients (particularly phosphorus) could have an impact on the extent of this qualifying feature due to excess algal growth. - Reductions in flow and subsequent increase in the deposition of fine material (particularly during autumn flushes) and decrease in dilution capacity of nutrients could have an impact on the extent of this qualifying feature. - When considering river flow, the impact of predicted changes *on Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	

Qualifying feature	Attribute	Adverse effects?	Mitigation and Monitoring
	Water chemistry – alkalinity	- Natural levels of alkalinity in the River Wensum is dependent on groundwater supply for in-river flows which will be reduced by the proposed drought permit. - When considering river flow, the impact of predicted changes *on Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	
	Water quality – nutrients and biological	- The annual average orthophosphate concentrations at Taverham Bridge monitoring station (2010 – 2020) was 0.07 mg/l. Although this is within the WFD 'Good' Environmental Quality Standards (EQS) threshold, the site is currently above the target of 0.03 mg/l by 2027 (interim goal of 0.05 mg/l by 2021) for the nutrients attribute. - Decreases in dilution capacity of nutrients (particularly phosphorus) could have an impact on the extent of this qualifying feature due to excessive algal growth and associated changes in species composition.	
White clawed crayfish Desmoulin's whorl snail Brook lamprey Bullhead	Population abundance	- Reduced flow/velocity in the River Wensum could cause the loss of suitable spawning habitat and sites that support juvenile populations. - Reductions in water depth could also increase predation risk of mobile species and impede upstream migration and passage. - The potential increase in phosphorus concentrations and therefore, diurnal dissolved oxygen sags could impact on respiratory requirements of fish and macroinvertebrate species. - When considering river flow, the impact of predicted changes on brook lamprey and bullheads cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	**Baseline measures (ongoing):** - River flow and water levels to be recorded at 15-minute intervals. - Groundwater monitoring at River Wensum SSSI units 38 and 39. - Investigation into current use of licenced and private abstractions. - Produce a water level management plan for River Wensum SSSI units 40-44. **Pre-drought measures (commence immediately before a drought):**

Qualifying feature	Attribute	Adverse effects?	Mitigation and Monitoring
	Conservation measures	- Desmoulin's whorl snail relies on a water table at or slightly above or below ground surface level to maintain damp conditions within the habitat. - Further monitoring and mitigation measures are required to conclude no adverse effects on Desmoulin's whorl snail. This is due to uncertainties regarding deterioration of suitable supporting habitat within proximity of the River Wensum.	- Monitoring of macrophytes, macroinvertebrates, fish survey and water quality to ensure accurate baseline of conditions. - Contact other abstractors. **During drought measures (commence in drought period as/if needed):** - Water level monitoring at Cotessey Pits and Taversham Lake as well as Land Parcels 40-44. - Enhanced phosphate, dissolved oxygen, ammonia, temperature and turbidity monitoring in River Wensum and Costessey Pits. - Increased macroinvertebrate and macrophyte sampling during the drought permit application and implementation. **Mitigation measures (commence on implementation of drought permit):** - Spray or drip irrigation to increase the humidity of the Desmoulin's whorl snail habitat and maintain water levels at SSSI units 38 to 39 (provided appropriate land management is in place at the time of the permit). - Implementation of the Water Level Management plan on SSSI units 40-44. - Fish removals to take place at Costessey Pits or Taverham Lake if water levels drop or water quality deteriorates significantly and that the fish are relocated to a suitable nearby receptor. - Mitigation of derogation through actions such as pump lowering, borehole deepening or compensation at potentially impacted other abstractors. **Post drought measures (commence after drought permit has been lifted):** - Continued ground and surface water monitoring at River Wensum SSSI units 38 to 44, Costessey Pits and
	Oxygen levels	- As flows in the river are not predicted to reduce significantly, dissolved oxygen saturation should be maintained and continue to support qualifying species and associated prey. - There could, however, be a relationship associated with increased phosphorus concentrations and resulting diurnal dissolved oxygen sags. - When considering river flow, the impact of predicted changes on brook lamprey and bullheads cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m³/day) and water velocity (m/s).	
	Juvenile densities	- Minor reductions in flow (particularly in Reach 3) could cause an increase in phosphorus concentrations, resulting in excess benthic algal growth. This could reduce the availability of suitable habitat including riffles and silt beds for juvenile qualifying species. - An increase in benthic algal growth will also indirectly increase sediment loading in the river. - Reductions in water flow, depth and wetted width of the River Wensum may change the function of suitable habitat for juvenile populations including riffles and silt beds. - Potential increases in fine material deposition could also reduce the suitability of habitats present. - When considering river flow, the impact of predicted changes on brook lamprey and bullheads cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m³/day) and water velocity (m/s).	

Qualifying feature	Attribute	Adverse effects?	Mitigation and Monitoring
		- Flow regime in Reach 3 is anticipated to exceed the 10% threshold during annual Q_{99} and therefore, the drought permit would not be compliant with the Conservation Objectives of the designated site. When considering river flow, the impact of predicted changes on brook lamprey and bullheads cannot be ruled out entirely given the uncertainty around the relationship between flow rate (m^3/day) and water velocity (m/s).	Taverham Lake to assess when mitigation measures are no longer required. - Surface water and groundwater quality monitoring will revert back to baseline sampling levels. - Additional ecological monitoring should continue up to three years after the cessation of the drought permit.
	Water quality/ quantity	- The annual average orthophosphate concentrations at Taverham Bridge monitoring station (2010 – 2020) was 0.07 mg/l. Although this is within the WFD 'Good' Environmental Quality Standards (EQS) threshold, the site is currently above the target of 0.03 mg/l by 2027 (interim goal of 0.05 mg/l by 2021) for the nutrients attribute. - Decreases in dilution capacity of nutrients (particularly phosphorus) could have an impact on the extent of this qualifying feature due to excessive algal growth and associated changes in species composition.	

5.4 Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit

5.4.1 Overview

Table 5.13 below provides a summary of the potential adverse effects of the proposed drought permit on the Breckland SAC. See Section 4.3.1 in the Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit EAR for more detail on the groundwater assessments

Table 5.13: Potential adverse effects of the Wellington Wellfield drought permit on Breckland SAC.

Impact	Details
Groundwater	Modelling has shown that baseline groundwater level depths range between 1.69 - 24.5m (summer) and 0.98 - 23.3m (winter) (see Section 4.3.1 in the Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit EAR). The minimum groundwater levels may decrease by 0.26m in summer and 0.22m in winter. Impacts during the summer can be screened out as the groundwater is not high enough where abstraction will cause Groundwater Dependent Terrestrial Ecosystem's (GWDTE's) conditions to decrease, therefore, impacts in summer are negligible. Given that the ground water levels in winter are already fairly low for GWDTE's (0.98m) and the abstractions may reduce this by a further 0.22m. Therefore, impacts on groundwater levels are assessed as moderate in winter.
Habitat loss	Reductions in groundwater may result in the lakes being unable to replenish and a decrease in available habitat for macrophyte communities and great crested newts. The reduction in water may result in the influx of opportunistic terrestrial grass species as the site may undergo succession should recharge rates not be sufficient. Waterbodies present within the Breckland SAC are known to occasionally dry out, however, the abstractions may exacerbate and extend the dry period experienced within the site. In addition, the health of alluvial forests may decline if there is a decline in groundwater supplies.

5.4.2 Potential adverse effects on qualifying features of Breckland SAC

Breckland SAC is approximately 75.48km² and therefore, covers a large area. Groundwater modelling undertaken for Breckland SAC (**Table 5.13**) considered the potential reduction in groundwater level across the entire site and does not provide detail on localised variations. The potential adverse effects of the proposed drought permit on the three qualifying features identified as groundwater dependent, will be determined based on an assessment of their specific location and anticipated reductions in groundwater on a local scale. The groundwater dependent qualifying features are natural eutrophic lakes, alluvial forests and great crested newts.

Natural eutrophic lakes associated with the Breckland SAC are located in the following underpinning SSSIs: Stanford Training Area and East Wretham Heath SSSI. In Stanford Training Area, SSSI unit 26, 81, 89 and 94 include groundwater dependent waterbodies. Apart from 89, which is in unfavourable – declining condition, the remaining SSSI units are in favourable condition. The closest SSSI unit that forms part of Stanford Training Area to Wellington Wellfield boreholes is 94 (West Tofts Mere), which is 7km east followed by 89 (Bagmore Pit), which is 8.5km north-east. In East Wretham Heath SSSI, unit 5 (Ringmere and Langmere) includes groundwater dependent waterbodies in unfavourable – declining condition, which is located 13.4km south-east to the closest borehole site. However, East Wretham Heath SSSI is outside of the estimated zone of influence, therefore, no adverse effects are anticipated.

A key pressure impacting on the condition of eutrophic lakes in Breckland SAC is nutrient pollution from agricultural practices. This has caused excessive growth of algae and lakes or lochs dominated by pondweed[105]. Natural eutrophic lakes have natural fluctuations in water level that can result in periods of dryness. Although there is an attribute target to maintain the extent of standing water within the meres

[105] Natural England (2015). Site Improvement Plan Breckland. Improvement Programme for England's Natura 2000 Sites (IPENS) Planning for the Future. 1 – 24.

at 0.22km², it is noted in the supplementary advice that typically the actual cover of water is lower than the attribute target[106].

Groundwater management is not considered a threat or a pressure for the qualifying features of the SAC, however, it is acknowledged that sufficient quantities of water are vitally important for maintaining the structure and function of this habitat type; particularly to support great crested newt populations.

Great crested newts associated with Breckland SAC are confined to populations in the Stanford Training Area SSSI and are found in meres, pingos, spring lines and low lying meadows. Based on surveys undertaken in 1997/98 and 2010/12, great crested newts have expanded their range within the SSSI occupying 64 waterbodies in 2010/12, in comparison to 45 in 1997/98[107]. Considering groundwater modelling across the SAC, impacts are more likely during the winter than the summer. Therefore, no impacts during the breeding season are anticipated. During the winter (air temperatures <5°C), great crested newts enter a period of low activity and become dormant, overwintering within terrestrial refuge sites including rock piles, dead wood or loose soil[108]. Therefore, it is not anticipated that implementation of the drought permit during the winter will have an adverse effect on great crested newt populations as they are not present in the waterbodies.

Alluvial forests with common alder and ash are largely present in Stanford Training Area SSSI, Cavenham-Icklingham Heaths SSSI and Thetford Golf Course SSSI. In the former SSSI, there are seven SSSI units that consist of broadleaved, mixed and yew woodland which are all in favourable condition (32, 37, 38, 51, 97, 99), apart from unit 35 which is in unfavourable – recovering condition. The closest unit to Wellington Wellfield boreholes is 37 (Waterhouse Madhouse), which is 6.1km north-east of the closest borehole. Unit 35 is approximately 12.4km north-east of Wellington Wellfield boreholes. The condition of the site has been assessed based on progress of restoring pingos and ponds within the boundaries of the unit for great crested newt, rather than the condition of the woodland habitat itself. Thetford Golf Course SSSI is 9.5km south-east from the closest Wellington Wellfield borehole. SSSI unit 7 and 8 are classified as broadleaved, mixed and yew woodland; the former is in unfavourable – recovering condition and the latter is in favourable condition. Cavenham-Icklingham Heaths SSSI is outside of the zone of influence of the proposed drought permit (16.7km south-west) and therefore, will not be considered further in this appropriate assessment. Within the supplementary advice for alluvial forests the quantity of groundwater should be maintained to a standard which provides the necessary conditions to support this feature. There is limited information on groundwater dependency and groundwater levels required to support common alder and ash.

Modelling within the boundaries of Thetford Golf Course SSSI has shown that baseline groundwater level depths range between -1.15m (above surface level) to 33.06m (summer) and -1.89m (above surface level) to 32.31 (winter) Modelling has shown that under abstraction conditions the groundwater depths will decrease by 0.01m in summer and 0.02m in winter, indicating that the cone of depression does not impact the groundwater levels within the SSSI and therefore, no adverse effects are anticipated in relation to alluvial forests present in the underpinning SSSI. Modelling has shown that baseline groundwater level depths range between -1.55m (above surface level) to 30.68m (summer) and -1.93 (above surface level) to 30.44m (winter) within the boundaries of Standford Training Area SSSI. The negative values indicate that groundwater levels lie above the land surface even during the modelled scenarios. As such, adverse effects to eutrophic lakes associated with Breckland SAC is deemed unlikely. Although modelling has shown that the groundwater level ranges are unlikely to change during the implementation of the drought permit, the potential impacts if implemented for a long duration are unknown. This is particularly a concern for Bagmore Pit that is in unfavourable – declining condition and <10km from Wellington Wellfield boreholes. Therefore, monitoring and mitigation measures are required.

[106] Natural England (2019). Breckland Special Area of Conservation (SAC) Site Code UK0019865. European Site Conservation Objectives: Supplementary advice on conserving and restoring site features. Natura 2000, 1 – 58.
[107] Natural England (2019). Breckland Special Area of Conservation (SAC) Site Code UK0019865. European Site Conservation Objectives: Supplementary advice on conserving and restoring site features. Natura 2000, 1 – 58.
[108] Langton, T., Beckett, C. & Foster, J. (2001). Great Crested Newt Conservation Handbook. Froglife, 1 – 60.

5.4.3 Summary

Based on groundwater assessments undertaken on relevant SSSIs underpinning Breckland SAC, and the associated location of groundwater dependent qualifying features, no adverse effects on the European designated site are anticipated. Uncertainty remains on the potential adverse effects if the drought permit was implemented for a duration longer than the 6 month application time period, however Anglian Water propose only using the permit within the month timescale. With the implementation of proposed mitigation measures (see **Table 5.14**), no adverse effects on groundwater dependent qualifying features of the Breckland SAC are anticipated.

Table 5.14: Potential adverse effects on Breckland SAC qualifying features in accordance with relevant attributes of the Conservation Objectives and monitoring and mitigation requirements.

Qualifying feature	Attribute	Adverse effects?	Mitigation and Monitoring
Natural eutrophic lakes	Extent of feature within the site	- Based on groundwater assessments, negligible impacts are anticipated from the proposed drought permit within Stanford Training Area SSSI and East Wretham SSSI which are the key underpinning SSSIs of Breckland SAC where the qualifying feature is present. - However, uncertainty remains on the potential adverse effects in Stanford Training Area SSSI if the drought permit is implemented for a long duration. Therefore, the following mitigation measures and monitoring is required.	**Pre-drought measures (commence immediately before a drought):** - Need to define groundwater thresholds to trigger mitigation implementation during drought permit. **Pre-drought trigger** - Trigger if monitoring results fall below pre-agreed levels. **Mitigation measures (commence on implementation of drought permit as/if needed):** - Cessation rules to halt abstraction if groundwater levels deteriorates below acceptable levels. - Variable abstraction to allow occasional pulses of water throughout the system to aid in the flushing of pollutants and prevent stagnation. **Evaluation of mitigation measures:** - Differences in groundwater levels and walkover surveys before and after mitigation measure implementation. Baseline/ threshold development will be determined from pre-drought monitoring and agreed between the Environment Agency and AWS.
	Macrophyte community structure		
	Hydrology		
Great crested newt	Population abundance	- As negligible impacts from the drought permit are anticipated during the summer, no adverse effects are expected during the breeding season that could therefore, impact on population abundance. - Based on groundwater assessments, negligible impacts are anticipated from the proposed drought permit within Stanford Training Area SSSI which is the key underpinning SSSI of Breckland SAC where key populations of great crested newt are present. - However, uncertainty remains on the potential adverse effects in Stanford Training Area SSSI if the drought permit is implemented for a long duration. Therefore, the following mitigation measures and monitoring is required.	
	Cover of macrophytes		
	Permanence of ponds		
	Water quantity/ quality		
	Overall Habitat Suitability Index score		
Alluvial forests	Hydrology	- Based on groundwater assessments, negligible impacts are anticipated from the proposed drought permit within Stanford Training Area SSSI and Thetford Golf Course SSSI which are the key underpinning SSSIs of Breckland SAC where the qualifying feature is present (within the zone of influence). - However, uncertainty remains on the potential adverse effects in Stanford Training Area SSSI if the drought permit is implemented for a long duration. Therefore, the following mitigation measures and monitoring is required.	
	Water quality/ quantity		
	Adaptation and resilience		

6 Potential In-Combination Effects with Other Plans and Projects

6.1 Potential In-combination effects of the Drought Plan

The HRA Stage 1 Screening (Table 3.1) concluded that the River Great Ouse (Offord Intake), River Nene (Wansford Intake/ Rutland Water), Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) and River Wensum (Costessey groundwater sources) drought permits could have LSE on European designated sites. The HRA Stage 2 Appropriate Assessment concluded that with the implementation of monitoring and mitigation measures no adverse effects on European designated sites were anticipated for the River Great Ouse (Offord Intake), River Nene (Wansford Intake/ Rutland Water), Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit. However, in-combination low level residual effects between options and with other plans and projects must be considered. Potential adverse effects on site integrity were identified on the River Wensum SAC due to the River Wensum (Costessey groundwater sources) drought permit.

This in-combination assessment between drought permits is detailed in Table 6.1. As Wansford Intake/ Rutland Water and River Nene (Pitsford Reservoir/ Duston Mill) are both hydrologically connected via the River Nene, in-combination effects have been considered.

Table 6.1: Anglian Water Drought Plan Options In-combination Effects

Option	In-Combination With	Relevant European Site	Effect In-Combination
River Nene (Wansford Intake/ Rutland Water)	River Nene (Pitsford Reservoir/ Duston Mill)	Nene Washes SAC, SPA and Ramsar	**No** – due to inputs from the Great Billing water recycling centre (WRC), Broadhome WRC and Flag Fen WRC increase water flows downstream of the abstraction point at Pitsford/ Duston Mill intake. Additionally, tributaries between the Pitsford/ Duston Mill and Rutland/ Wansford intake assist in diluting nutrient concentrations in the River Nene. Therefore, no in-combination effects are anticipated.
		The Wash and Norfolk Coast SAC	**No** – due to structural controls along the River Nene and the input of additional flows from WRCs and tributaries, no in-combination effects are anticipated.
		The Wash SPA and Ramsar site	**No** – due to structural controls along the River Nene and the input of additional flows from WRCs and tributaries, no in-combination effects are anticipated.
		Rutland Water SPA and Ramsar site	**No** - due to the contribution of water supplies from connecting tributaries and other discharges that are expected to dilute nutrient concentrations in the River Nene during low flow periods. In addition, Rutland Water is also supplied water via WRCs and tributaries between Pitsford/ Duston Mill and Wansford under drought permit conditions. Previous assessments (Atkins, 2012) also concluded there would be no in-combination effects should drought options be implementation at the same time. Therefore, no in-combination effects are anticipated.

Option	In-Combination With	Relevant European Site	Effect In-Combination
River Nene (Wansford Intake/ Rutland Water)	River Great Ouse (Offord intake)	The Wash and Norfolk Coast SAC	**No** – As there is negligible hydrological impact from the Wansford/ Rutland intake on The Wash and Norfolk Coast SAC, no in-combination effects with Offord intake are anticipated.
		The Wash SPA and Ramsar site	**No** – As there is negligible hydrological impact from the Wansford/ Rutland intake on The Wash and Norfolk Coast SAC, no in-combination effects with Offord intake are anticipated.
Wellington Wellfield and Denton Lodge (Stoke Ferry Intake)	River Great Ouse (Offord Intake)	No overlapping sites within 10km	No – no overlapping European sites and no in-combination effects.
Wellington Wellfield and Denton Lodge (Stoke Ferry Intake)	River Nene (Wansford Intake/ Rutland Water)	No overlapping sites within 10km	No – no overlapping European sites and no in-combination effects.

6.2 Anglian Water's Water Resource Management Plan (2019)

In 2019 AWS published their final WRMP 2019 which sets out how they plan to provide a secure and sustainable supply of water for their customers over the next 25 years, from 2020 to 2045.

AWS has examined the supply/demand balance for each WRZ and determined how any deficits between forecast demand and reliable water supplies should be addressed for the selected planning period. A wide range of alternative options has been considered by AWS to address any forecast supply shortfalls, including:

- alternative water tariffs to encourage water efficiency (linked to Thames Water's strategy to continue extending water metering to the majority of its customers)
- promotion of water efficiency measures
- reducing water leakage from the water supply network or at customers' properties
- water transfers from other water companies or other owners of water sources
- desalination
- indirect water reuse
- river or groundwater abstraction
- new reservoirs
- increased transfer of water between WRZs.

WRMP 2024 will be published in late 2024. As such, an assessment of in-combination effects has been undertaken considering WRMP19. This includes the following WRMP schemes:

- ESU1 Felixstowe Desalination
- ESU2 Ipswich Water Reuse
- NFN1 Kings Lynn Desalination
- SHB2 Pyewipe Water Reuse for non-potable use
- NFN2 Kings Lynn Water Reuse
- NFN3 Fenland Reservoir

6.2.1 Offord Intake

There is no overlap in European Sites considered for the Offord Intake (see **Table 3.1**) and the Felixstowe Desalination, Ipswich Water Reuse and Pyewipe Water Reuse options.

Both Kings Lynn Desalination option and Offord intake on the River Great Ouse considered the LSEs during construction and operation on the following European sites in the WRMP19 HRA[109] and draft DP22 HRA: The Wash SPA, The Wash Ramsar and The Wash and North Norfolk Coast SAC. LSEs of the Kings Lynn Desalination option were not ruled out due to potential pollution incidents affecting water quality during construction and changes in salinity regime due to the brine discharge during operation. It is assumed that appropriate mitigation can be developed to ensure there are no adverse effects on the European Sites. The Offord intake has been assessed not to have the potential for adverse water quality and a robust mitigation strategy has been devised to ensure the integrity of the European Sites, therefore if appropriate mitigation is implemented for both Kings Lynn Desalination and the Offord intake there should be no in-combination LSEs.

The Kings Lynn Water Reuse option in the WRMP and the Offord Intake on the River Great Ouse consider the impacts on The Wash SPA, The Wash Ramsar and The Wash and North Norfolk Coast SAC. The impacts of Kings Lynn Water Reuse on the European sites relates to pollution events during construction which may impact water quality. However, it is assumed appropriate mitigation will be put in place and therefore no likely significant effects are likely to occur. The Offord Intake has been assessed not to have the potential for adverse water quality and a robust mitigation strategy has been devised to ensure the integrity of the European Sites, therefore if appropriate mitigation is implemented for both Kings Lynn Water Reuse and the Offord intake there should be no in-combination LSEs.

The impacts of both Fenland Reservoir and Offord Intake, Great River Ouse on the Ouse Washes SAC/Ramsar Site/SPA have been considered in the WRMP19 HRA and draft DP22 HRA. Both required Stage 2 Appropriate Assessments due to potential impacts on the European Sites. It was identified that the reservoir option could cause impacts relating to water pollution, through construction of transfer 02b-0321-ai, in the Ouse Washes; this is expected to be temporary during construction only. It was concluded in the Stage 2 Appropriate Assessment of the proposed drought permit at Offord Intake on the River Great Ouse that downstream impacts of reduced flow on water quality will not adversely affect the integrity of the European Sites. However, it is noted that no quantitative analysis has been undertaken and therefore the “no adverse effect assessment” cannot be deemed to have a high confidence level. In-combination LSEs could arise as a result of both plans being implemented, however, both the WRMP and Drought Plan have outlined plans for mitigation to be installed to ensure any effects of the plans do not adversely affect the European Sites.

6.2.2 Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford Intake and the Felixstowe Desalination, Ipswich Water Reuse, Pyewipe Water Reuse and Fenland Reservoir options.

Kings Lynn Desalination option (WRMP) considers the LSEs on The Wash SPA, The Wash Ramsar and The Wash and North Norfolk Coast SAC as does the drought plan Wansford Intake on the River Nene. The level of detail in the WRMP does not allow detailed consideration of the effects on the European sites, however there is a likelihood for LSEs during both construction and operation of the option. These are again related to pollution events affecting water quality during construction and changes in salinity as a result of brine discharge during operation. It is assumed that appropriate mitigation can be developed to ensure there are no adverse effects on the European Sites. Wansford Intake may lead to eutrophication which could affect the spined loach population, but appropriate mitigation has been identified, therefore if mitigation is implemented for both Kings Lynn Desalination and Wansford Intake, no in-combination LSEs are anticipated.

The Kings Lynn Water Reuse option in the WRMP and Wansford Intake on the River Nene consider the impacts on The Wash SPA, The Wash Ramsar and The Wash and North Norfolk Coast SAC. The

[109] Mott MacDonald (2019). Anglian Water – Water Resources Management Plan. Habitats Regulations Assessment – Task I: Screening. Report for Anglian Water Services Ltd.

impacts of Kings Lynn Water Reuse on the European sites relates to pollution events during construction which may impact water quality. However, it is assumed appropriate mitigation will be put in place and therefore no LSEs are likely to occur. Wansford Intake may lead to eutrophication which could affect the spined loach population, but appropriate mitigation has been identified, therefore if mitigation is implemented for both Kings Lynn Water Reuse and Wansford Intake, no in combination LSEs are anticipated.

6.2.3 Wellington Wellfield

Both the Fenland Reservoir option and Wellington Wellfield drought permit considered the potential LSE on Breckland SAC, SPA and Ramsar site. LSEs from Fenland reservoir were identified during construction of new pipeline infrastructure that could potentially cause disturbance impacts and habitat deterioration via trampling. The identified impact pathways will be mitigated via timing of works and re-routing the pipeline to avoid key habitat features[110]. As the impact pathways identified for Wellington Wellfield are in relation to groundwater supply, no in-combination effects have been identified from Fenland Reservoir option and Wellington Wellfield drought permit.

6.3 Environment Agency Drought Plans

The potential for in-combination effects of AWS draft DP22 with the Environment Agency's National Drought Action Plan has been assessed.

Part of the Environment Agency's role is to reduce the impact of drought on the natural environment by taking specific actions. The Environment Agency can apply for environmental drought orders if the environment is suffering serious damage because of abstraction during a drought. The plan says that the Environment Agency would work with stakeholders including water companies to identify where and when it would be necessary and its potential effects on any essential public supplies or infrastructure.

An overview of the process of using drought actions and triggers is provided in the Environment Agency National Drought Action Plan. Actions described include communications (internal and external), monitoring and drought orders. External communications may have positive in-combination effects with AWS media/water efficiency campaign demand side option, as drought communication messages may reinforce each other, thereby resulting in increased demand savings.

Environment Agency environmental drought order actions have the potential to have in-combination impacts with AWS draft DP22. The Environment Agency can apply to the Secretary of State for environmental drought orders if the environment is suffering serious damage as the result of abstraction during a drought. Nevertheless, liaison is required with the Environment Agency to permit the operation of the DP schemes, and the Environment Agency also monitor the actions taken to ensure these are in accordance with any drought permits/orders.

6.3.1 East Anglia Area (Cambridgeshire and Bedfordshire)

Offord Intake

The level of detail in the Environment Agency drought plan does not allow consideration of the effect on individual European Sites, however it is anticipated that they may need to make a drought order for the Ely Ouse to Essex Transfer Scheme and the Great Ouse Groundwater scheme. This could potentially result is in-combination LSEs with the drought permit for the Offord Intake for the Ouse Washes, Portholme SAC, and The Wash. This would need to be considered further.

Wansford Intake**/ Rutland Water**

There is no overlap in European Sites considered for the Wansford intake and East Anglia Area Environment Agency Drought Plan.

[110] Mott MacDonald (2019). Anglian Water – Water Resources Management Plan, Habitats Regulations Assessment – Task I: Screening. Anglian Water Services Ltd.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield drought permit and East Anglia Area Environment Agency Drought Plan.

6.3.2 Lincolnshire and Northampton

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Lincolnshire and Northampton Environment Agency Drought Plan.

Wansford Intake**/ Rutland Water**

There is no overlap in European Sites considered for the Wansford intake and Lincolnshire and Northampton Environment Agency Drought Plan.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield drought permit and Lincolnshire and Northampton Environment Agency Drought Plan.

6.3.3 East Anglia (East)

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the East Anglia (East) Environment Agency Drought Plan.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and East Anglia (East) Environment Agency Drought Plan.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield drought permit and East Anglia (East) Environment Agency Drought Plan.

6.4 Other Water Company Drought Plans

Assessment of the potential for in-combination effects of supply side and drought permit/order options listed in neighbouring water companies' DPs has been undertaken.

It should be noted that DPs for other companies/organisations are subject to review on timescales that may not be aligned with the timescales of AWS DP revision. The information used to carry out these assessments is considered to be the most up to date information available at time of writing, but the assessments should be reviewed at the time of drought option implementation to ensure that no changes to the neighbouring water company drought options has been made in the intervening period, and that the assessment, therefore remains valid.

The following neighbouring watering company DPs were considered:

- Cambridge Water (2018)
- Affinity Water (2017)
- Yorkshire Water (2019)
- Severn Trent Water (2019)
- Essex and Suffolk Water (2018)

6.4.1 Cambridge Water

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and Cambridge Water's Drought Plan.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Cambridge Water's Drought Plan.

Wellington Wellfield

Both the Thetford sources within Cambridge Water's Drought Plan and Wellington Wellfield drought permit in Anglian Water's Drought Plan have identified potential LSE at Breckland SAC. More specifically, Thetford sources identified East Wretham Heath SSSI as particularly vulnerable to effects of the drought permit. The impact pathway of both drought permits is a reduction in groundwater supply which supports groundwater dependent qualifying features of Breckland SAC. Therefore, there is potential for in-combination effects. Cambridge Water conducted a study which involved a programme of test pumping, monitoring and modelling in order to further assess the potential LSEs from the Thetford option. The study concluded that negligible impacts from the drought option were anticipated on the meres within the East Wretham Heath SSSI[111]. In addition, East Wretham Heath SSSI specifically is outside of the zone of influence of the proposed Wellington Wellfield drought permit. Therefore, no in-combination effects are anticipated are anticipated.

6.4.2 Affinity Water

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Affinity Water's Drought Plan.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Affinity Water's Drought Plan.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield drought permit and Affinity Water's Drought Plan.

6.4.3 Yorkshire Water

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Yorkshire Water's Drought Plan.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Yorkshire Water's Drought Plan.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield and Yorkshire Water's Drought Plan.

6.4.4 Severn Trent Water

Offord Intake

There is no overlap in European sites considered for the Offord intake and Severn Trent Drought Plan.

Wansford Intake/ Rutland Water

[111] Cambridge Water (2021). Environmental Assessment and Monitoring, Appendix E. Draft drought plan 2021. 1 – 27.

There is no overlap in European sites considered for the Wansford intake and Severn Trent Drought Plan.

Wellington Wellfield

There is no overlap in European sites considered expectation for the Wellington Wellfield drought permit and Severn Trent Drought Plan.

6.4.5 Essex and Suffolk Water

Offord Intake

A screening exercise to determine if a SEA was required was undertaken and concluded that the supply-side actions would not have a significant effect on the environment. As a result, no in combination LSEs are anticipated between the Offord Intake, River Great Ouse and Essex and Suffolk Water Drought Plan.

Wansford Intake**/ Rutland Water**

A screening exercise to determine if a SEA was required was undertaken and concluded that the supply-side actions would not have a significant effect on the environment. As a result, no in combination LSEs are anticipated between Wansford intake and Essex and Suffolk Water Drought Plan.

Wellington Wellfield

A screening exercise to determine if a SEA was required was undertaken and concluded that the supply-side actions would not have a significant effect on the environment. As a result, no in-combination LSEs are anticipated between Wellington Wellfield drought permit and the Essex and Suffolk Water Drought Plan.

6.5 Other Water Company WRMPs

Assessment of the potential for in-combination effects with AWS draft DP22 and neighbouring water companies' WRMPs has been undertaken.

It should be noted that all WRMPs are subject to review every five years. The information used to carry out these assessments is considered to be the most up to date information publicly available at time of writing. Where possible, this is also informed through on-going discussions that AWS is holding with neighbouring water companies in order to identify any water resource options which may have the potential to cause in-combination impacts with their drought options. The assessments should be reviewed at the time of drought option implementation to ensure that no changes to the WRMPs have been made in the intervening period, and that the assessment, therefore remains valid. For example, the other water company WRMPs will be developed and issued during the period of AWS DP22.

6.5.1 Affinity Water WRMP19

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Affinity Water's WRMP.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Affinity Water's WRMP.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield drought permit and Affinity Water's WRMP.

6.5.2 Severn Trent Water WRMP19

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Severn Trent Water's WRMP.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Severn Trent Water's WRMP.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield drought permit and Severn Trent Water's WRMP.

6.5.3 Yorkshire Water WRMP19

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Yorkshire Water's WRMP.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Yorkshire Water's WRMP.

Wellington Wellfield

There is no overlap in European Sites considered for the Wellington Wellfield drought permit and Yorkshire Water's WRMP.

6.5.4 Cambridge Water WRMP19

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Cambridge Water's WRMP.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Cambridge Water's WRMP.

Wellington Wellfield

A number of Cambridge Water's Water Resource Management Plan feasible options have been identified that could have potential LSEs on Breckland SAC, SPA and Ramsar site. These include 2 high flow winter reservoirs – 2 sites, 2 high flow winter reservoirs – 3 sites, 4 high flow winter reservoirs – 4 sites, string of high flow winter reservoirs – 4 sub-option with smaller overall DO, CW30: EOETS with new res, Ely Ouse Essex Transfer with new res (shared with AWS) – sub-option with smaller DO, CW33: adopt Beck Row and CW49: Trade with AWS GW licences in Thetford area[112].

None of these options were included in the preferred programme. As such, no potential in-combination effects with the Wellington Wellfield drought permit option is anticipated.

6.5.5 Essex and Suffolk Water WRMP19

Offord Intake

There is no overlap in European Sites considered for the Essex and Suffolk Water WRMP19 and Offord Intake.

Wansford Intake/ Rutland Water

[112] Ricardo Energy and Environment (2019). Final Water Resources Management Plan 2019 Strategic Environmental Assessment. Cambridge Water, 1 – 83.

There is no overlap in European Sites considered for the Essex and Suffolk Water WRMP19 and Wansford Intake/ Rutland Water.

Wellington Wellfield

There is no overlap in European Sites considered for the Essex and Suffolk Water WRMP19 and Wellington Wellfield drought permit.

6.6 Other Plans and Projects

6.6.1 Water Resources East (WRE)

Offord Intake

There is currently no HRA for the WRE plan therefore any in-combination effects cannot be assessed as this time.

Wansford Intake/ Rutland Water

There is currently no HRA for the WRE plan therefore any in-combination effects cannot be assessed as this time.

Wellington Wellfield

There is currently no HRA for the WRE plan therefore any in-combination effects cannot be assessed as this time.

6.6.2 Anglian River Basin Management Plan (RBMP)

Offord Intake

The level of detail in the plan does not allow consideration of the effect on individual European Sites, but the HRA determines that the RBMP is not likely to have any significant effects on any European sites, alone or in-combination with other plans and projects. Therefore, no in-combination LSEs with Offord Intake are anticipated.

Wansford Intake/ Rutland Water

The level of detail in the plan does not allow consideration of the effect on individual European Sites, but the HRA determines that the RBMP is not likely to have any significant effects on any European sites, alone or in-combination with other plans and projects. Therefore, no in-combination LSEs with Wansford Intake are anticipated.

Wellington Wellfield

The level of detail in the plan does not allow consideration of the effect on individual European Sites, but the HRA determines that the RBMP is not likely to have any significant effects on any European sites, alone or in-combination with other plans and projects. Therefore, no in-combination LSEs with Wellington Wellfield drought permit are anticipated.

6.6.3 National Policy Statement – Sizewell C

Offord Intake

There is no overlap in European Sites considered for the Offord Intake, River Great Ouse and the Sizewell C construction or operation.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and Sizewell C construction or operation.

Wellington Wellfield

There is no overlap in European Sites considered for Wellington Wellfield drought permit and Sizewell C construction or operation.

6.6.4 A14 upgrade

Offord Intake

Both the A14 upgrade HRA and AWS draft DP22 consider the impact of their works on Portholme SAC, Ouse Washes SAC, Ouse Washes SPA and Ouse Washes Ramsar. The A14 upgrade HRA concludes that there are no LSEs on the qualifying features on the above European sites. A Stage 2 Appropriate Assessment of the proposed drought permit at Offord Intake on the River Great Ouse was required for Ouse Washes SAC, Ouse Washes SPA and Ouse Washes Ramsar and concluded that downstream impacts of reduced flow on water quality will not adversely affect the integrity of the European Sites. However, it is noted that no quantitative analysis has been undertaken and therefore the “no adverse effect assessment” cannot be deemed to have a high confidence level. The effect of the drought plan on Portholme SAC was deemed to have no LSEs and was screened out in Stage 1. Due to the nature of the schemes and associated impacts and despite the uncertainties surrounding the effect of reduced flow on the Ouse Washes sites, no in-combination effects are anticipated.

Wansford Intake/ Rutland Water

There is no overlap in European Sites considered for the Wansford intake and the A14 upgrade.

Wellington Wellfield

There is no overlap in European Sites considered for Wellington Wellfield drought permit and the A14 upgrade.

6.6.5 Cambridge-Milton Keynes-Oxford corridor

No further details are available on this scheme at present to undertake an in-combination assessment with the Offord intake, Wansford intake and Wellington Wellfield drought permit. This would be reviewed further in the event of a potential drought permit application particularly for the Offord intake permit.

6.6.6 East West Rail

There is no HRA for East West Rail as there are no European Sites that could be affected by the scheme and therefore, no in-combination effects with Offord intake, Wansford intake and Wellington Wellfield drought permit are anticipated.

7 Conclusions and Recommendations

AWS has completed an updated HRA Stage 1 Screening Assessment to identify if any of the draft DP22 demand side and supply side drought options could lead to LSEs on European designated sites. The HRA Stage 1 Screening concluded that the River Great Ouse (Offord Intake), River Nene (Wansford Intake/ Rutland Water), River Wensum (Costessey groundwater sources) and Wellington Wellfield and Denton Lodge (Stoke Ferry Intake) drought permit had potential to cause LSEs on European designated sites alone and they were taken through to Stage 2 Appropriate Assessment. A Stage 2 Appropriate Assessment was required to determine whether the drought permits would result in an adverse effect on site integrity of European designated sites, in light of Conservation Objectives.

Potential impact pathways that could lead to LSEs from Offord Intake included reductions in flow rate downstream of the intake causing water quality deterioration during the summer (particularly orthophosphate concentrations, biochemical oxygen demand and dissolved oxygen saturation) and increased siltation. After further consideration of these impact pathways, the HRA Stage 2 Appropriate Assessment concluded that the proposed drought permit will not result in an adverse effect on site integrity, due to the implementation of a monitoring and mitigation programme. This includes a suspension on the transfer of water from the tidal river into the counter drain at the Old Bedford Sluice and pre-treatment of wastewater discharges from Huntingdon Godmanchester WRC within Reach 2. The monitoring programme will ensure that if significant effects are recorded for orthophosphate concentrations or dissolved oxygen within the European sites, abstraction is stopped. Implementation of a robust mitigation package has also been devised to provide a high degree of confidence that no adverse effects to the integrity of the designated sites will occur. This does not include monitoring or mitigation for potential adverse effects due to increased siltation however, in-channel substrate character must be maintained at 20% sand and no more than 40% silt for spined loach[113]. Therefore, a review of current site management and potential sediment monitoring methods before, during and after the operation of this drought option is recommended to prevent adverse effects on site integrity.

For the proposed Wansford Intake/ Rutland Water drought permit, water flow reduction and the resultant nutrient enrichment and increased siltation were identified as potential impact pathways that could lead to LSE on the Nene Washes SAC, SPA and Ramsar site. Interest features of the European for the Nene Washes include spined loach and internationally important bird assemblages; both of which are susceptible to the impacts of nutrient enrichment and increased siltation on supporting macrophyte habitat. Eutrophication of the Nene Washes could affect the spined loach population via reduced food availability, habitat loss and low dissolved oxygen concentrations at the sediment-water interface. Bird assemblages may also be impacted by the effects of eutrophication on food availability. The HRA Stage 2 Appropriate Assessment concluded that the proposed drought permit will not result in an adverse effect on site integrity due to the implementation of a monitoring and mitigation programme. Mitigation measures included the following: pre-treatment of wastewater discharges either from Nene at Wansford or Wittering Brook; variable abstraction; and cessation of abstraction during periods of stress. A monitoring programme has also been devised to assess fluctuations in abiotic parameters during implementation. In addition, LSE were identified on Rutland Water SPA and Ramsar site due to the proposed Wansford Intake/ Rutland Water drought permit. This was due to high orthophosphate concentrations in water being abstracted and discharged into Rutland Water from the River Nene. In order to mitigate for the potential adverse effects on Rutland Water SPA and Ramsar site, pre-treatment of abstracted water has been proposed before discharge into Rutland Water. This will involve phosphate stripping to ensure discharged water is compliant with WFD 'Good' EQS standards for moderate alkalinity, deep waterbodies.

For the proposed Wellington Wellfield drought permit, a reduction in groundwater supply within Breckland SAC was identified as a potential impact pathway that could affect groundwater dependent qualifying features. This included natural eutrophic lakes, great crested newts and alluvial forests. The HRA Stage 2 Appropriate Assessment concluded that the proposed drought permit will not result in an adverse effect on site integrity due to groundwater assessments undertaken on relevant SSSIs

[113] Natural England (2015). European Site Conservation Objectives: supplementary advice on conserving and restoring site features. Ouse Washes Special Area of Conservation (SAC) Site Code: UK0013011. Natura 2000, 1-12.

underpinning Breckland SAC, and the associated location of groundwater dependent qualifying features. Uncertainty remains on the potential adverse effects if the drought permit was implemented for a duration longer than the 6 month application time period, however Anglian Water propose only using the permit within the month timescale. With the implementation of proposed mitigation measures, no adverse effects on groundwater dependent qualifying features of the Breckland SAC are anticipated.

For the proposed Costessey groundwater sources drought permit, water flow reduction and the resultant decrease in wetted width of associated habitats, water quality deterioration and increase siltation were identified as potential impact pathways that could cause LSEs on the River Wensum SAC. The HRA Stage 2 Appropriate Assessment screened out water quality deterioration and potential impacts on qualifying fish species. However, the predicted reduction in groundwater levels as a result of the Costessey groundwater sources has the potential to adversely effect on Desmoulin's whorl snail at SSSI Units 38/39 and 40-44. In addition, implementation of the drought permit may cause further deterioration in orthophosphate concentrations that are currently exceeding the attribute target within the supplementary advice and the flow regime in Reach 3 is anticipated to exceed the 10% attribute target threshold during annual Q_{99} in comparison to naturalised flows.

In-combination effects of AWS's draft DP22 with AWS's Water Resource Management Plan (WRMP) 2019, the Environment Agency's regional DPs, other water company WRMPs and DPs and other major infrastructure projects are not considered likely to have adverse effects on European sites. This assessment is based on information available at the time of writing.

Provided that proposed monitoring and mitigation measures are implemented for Offord Intake, Wansford Intake/ Rutland Water and Wellington Wellfield drought permit, no further stage in the Appropriate Assessment process is considered necessary. These are the same conclusions as drawn for DP19 and agreed through DP19 consultation with both the Environment Agency and Natural England.

Further monitoring is required to assess the potential impact of the Costessey groundwater drought permit option upon the current condition of the River Wensum SAC and to inform if appropriate mitigation measures can be implemented to conclude no adverse effects for all of the qualifying features of the River Wensum SAC. Following the collection of data and its analysis, the Stage 2 assessment will need to be revisited, to update the outcome and to provide confirmation provided on the appropriate mitigation measures that could reduce the potential for adverse effects.

The 'standard' supply and demand side actions remain substantially the same as for the DP19, with no new options except for an additional demand side action, and as a result these have all already been consulted on with the Environment Agency and Natural England. The extreme supply side and extreme demand site drought actions are new but at present are theoretical only and not well defined., Therefore, it is not possible to undertake an HRA assessment of these actions at this time.

A summary of the conclusions of the HRA Stage 1 Screening Assessment and Stage 2 Appropriate Assessment are provided in Table 7.1.

Table 7.1: Summary of HRA Stage 1 Screening Assessment and Stage 2 Appropriate Assessment of Anglian Water's draft Drought Plan 2022 options.

Drought Option	Is scheme likely to have a significant effect on European site(s) alone?	Effect in-combination with other drought options?	Appropriate Assessment required?	Adverse effect on integrity of European site?
Supply Side Options				
River Colne (Ardleigh Reservoir) drought permit	No	No	No	N/A
River Great Ouse (Offord Intake) drought permit	Yes	No	Yes	No - with monitoring and mitigation measures
River Nene (Pitsford Reservoir/Duston Mill) drought permit	No	No	No	N/A
River Nene (Wansford Intake/ Rutland Water) drought permit	Yes	No	Yes	No - with monitoring and mitigation measures
River Trent (Hall Water Treatment Works) drought permit	No	No	No	N/A
River Wensum (Costessey groundwater sources) drought permit	Yes	No	Yes	Yes
Wellington Wellfield drought permit	Yes	No	Yes	No – with monitoring and mitigation measures
Demand Side Options				
Customer metering	No	No	No	N/A
Targeted leakage reduction	No	No	No	N/A
Communication campaigns and messaging	No	No	No	N/A
Water efficiency activities	No	No	No	N/A
Temporary Use Bans	No	No	No	N/A
Non-Essential Use Bans	No	No	No	N/A
Emergency drought orders (rota cuts)	No	No	No	N/A
Extreme Supply Side Options				
Groundwater support	N/A	N/A	N/A	N/A
River support	N/A	N/A	N/A	N/A
Temporary treatment	N/A	N/A	N/A	N/A
Utilising other significant water bodies	N/A	N/A	N/A	N/A
Overland pipes	N/A	N/A	N/A	N/A

Drought Option	Is scheme likely to have a significant effect on European site(s) alone?	Effect in-combination with other drought options?	Appropriate Assessment required?	Adverse effect on integrity of European site?
Tankering	N/A	N/A	N/A	N/A
Desalination	N/A	N/A	N/A	N/A
Effluent re-use	N/A	N/A	N/A	N/A
Sea tankering	N/A	N/A	N/A	N/A
Resource trading and transfers	N/A	N/A	N/A	N/A
Supply schemes				
Extreme Demand Side Options				
Customer metering	N/A	N/A	N/A	N/A
Household and non-household incentivisation	N/A	N/A	N/A	N/A
Extreme communications plan	N/A	N/A	N/A	N/A
Targeted leakage reduction	N/A	N/A	N/A	N/A
Extreme pressure management	N/A	N/A	N/A	N/A
District metering	N/A	N/A	N/A	N/A
Removal of exceptions	N/A	N/A	N/A	N/A

Appendices

A1 European designated sites summaries

Site name	Reason for designation	Threats and pressures
Portholme SAC	**Annex I habitats that are a primary reason for selection of this site** ● Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) This large site represents lowland hay meadows in eastern England. It is the largest surviving traditionally-managed meadow in the UK. There has been a long history of favourable management and very little of the site has suffered from agricultural improvement, and so it demonstrates good conservation of structure and function. It supports a small population of fritillary (*Fritillaria meleagris*).	• Inappropriate water levels (threat) • Water pollution (threat)
Ouse Washes SAC	**Annex II species that are a primary reason for selection of this site** ● Spined loach (*Cobitis taenia*) The area represents spined loach populations within the River Ouse catchment. The Counter Drain, with its clear water and abundant macrophytes, is particularly important, and a healthy population of spined loach is known to occur.	• Inappropriate water levels (pressure) • Water pollution (threat)
Ouse Washes Ramsar site	**Ramsar Criterion 1** The site is one of the most extensive areas of seasonally-flooding washland of its type in Britain. The site supports several nationally scarce plants, including: small water pepper (*Polygonum minus*), whorled water-milfoil (*Myriophyllum verticillatum*), greater water parsnip (*Sium latifolium*), river waterdrop wort (*Oenanthe fluviatilis*), fringed water-lily (*Nymphoides peltate*), long-stalked pondweed (*Potamogeton praelongus*), hair-like pondweed (*Potamogeton trichoides*), grass-wrack pondweed (*Potamogeton compressus*), tasteless water-pepper (*Polygonum mite*), marsh dock (*Rumex palustris*). The site holds relict fenland fauna, including: large darter dragonfly (*Libellula fulva*) and rifle beetle (*Oulimnius major*). The site supports a diverse assemblage of nationally rare breeding waterfowl associated with seasonally-flooding wet grassland. **Ramsar Criterion 5** Assemblages of international importance. Species with peak counts in the winter: 59133 waterfowl (5-year peak mean 1998/99-2002/03). **Ramsar Criterion 6** Species/populations occurring at levels of international importance. Winter: Tundra swan (*Cygnus columbianus bewickii*), whooper swan (*Cygnus Cygnus*), Eurasian wigeon (*Anas penelope*), gadwall (*Anas strepera strepera*), Eurasian teal (*Anas crecca*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*). Species identified subsequent to designation for possible future consideration: Mute swan (*Cygnus olor*), common pochard (*Aythya farina*), black-tailed godwit (*Limosa limosa islandica*).	No information available.
Ouse Washes SPA	**Article 4.1 species of importance listed in Annex 1** ● Over winter the area regularly supports: *Circus cyaneus, Cygnus columbianus bewickii, Cygnus Cygnus, Philomachus pugnaz.* **Article 4.2 species of importance not listed in Annex 1** ● During the breeding season the area regularly supports: *Anas clypeata, Anas platyrhynchos, Anas querquedula, Limosa limosa limosa.* ● During the winter the area regularly supports: *Anas acuta, Anas clypeata, Anas crecca, Anas penelope, Anas strepera, Aythya farina, Aythya fuligula, Cygnus olor, Fulica atra, Phalacrocroax carbo.* An internationally important assemblage of birds – over winter the area regularly supports 64428 waterfowl, including: *Phalacrocorax carbo, Cygnus columbianus bewickii, Cygnus Cygnus, Anas penelope, Anas Strepera, Anas crecca, Anas acuta, Anas clypeata, Aythya farina, Aythya fuligula, Fulica atra, Philomachus pugnax.*	• Inappropriate water levels (pressure) • Water pollution (threat)

Site name	Reason for designation	Threats and pressures
The Wash and North Norfolk Coast SAC	**Annex I habitats that are a primary reason for selection of this site** ● Sandbanks which are slightly covered by sea water all the time ● Mudflats and sandflats not covered by seawater at low tide ● Large shallow inlets and bays ● Reefs ● Salicornia and other annuals colonizing mud and sand ● Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) ● Mediterranean and thermos-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) **Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site** ● Coastal lagoons (priority feature) **Annex II species that are a primary reason for selection of this site** ● Harbour seal (*Phoca vitulina*) **Annex II species present as a qualifying feature, but not a primary reason for site selection** ● Otter (*Lutra lutra*)	● Inappropriate water levels (pressure) ● Public Access/ Disturbance (threat) ● Siltation (threat) ● Fisheries: Recreational marine and estuarine (threat) ● Invasive species (threat) ● Inappropriate coastal management (threat) ● Fisheries: Commercial marine and estuarine (threat) ● Predation (threat) ● Coastal squeeze (threat) ● Change in land management ● Air pollution: Impact of atmospheric nitrogen deposition ● Changes in species distribution
The Wash SPA	**Article 4.1 species of importance listed in Annex 1** Internationally important populations supported: ● During the breeding season - common tern (*Sterna hirundo*), little tern (*Sterna albifrons*), marsh harrier (*Circus aeruginosus*). ● Over winter - avocet (*Recurvirostra avosetta*), bar-tailed godwit (*Limosa lapponica*), golden plover (*Pluvialis apricaria*), whooper swan (*Cygnus cygnus*). **Article 4.2 species of importance not listed in Annex 1** Supports populations of European importance of the following migratory species: ● On passage – ringed plover (*Charadrius hiaticula*), sanderling (*Calidris alba*). ● Over winter - black-tailed godwit (*Limosa limosa islandica*), curlew (*Numenius arquata*), dark-bellied brent goose (*Branta bernicla bernicla*), dunlin (*Calidris alpina alpina*), grey plover (*Pluvialis squatarola*), knot (*Calidris canutus*), oystercatcher (*Haematopus ostralegus*), pink-footed goose (*Anser brachyrhynchus*), pintail (*Anas acuta*), redshank (T*ringa totanus*), shelduck (*Tadorna tadorna*), turnstone (*Arenaria interpres*). Over winter, the area regularly supports 400,273 individual waterfowl.	● Inappropriate water levels (pressure) ● Public Access/ Disturbance (threat) ● Siltation (threat) ● Fisheries: Recreational marine and estuarine (threat) ● Invasive species (threat) ● Inappropriate coastal management (threat) ● Fisheries: Commercial marine and estuarine (threat) ● Predation (threat) ● Coastal squeeze (threat) ● Change in land management ● Air pollution: Impact of atmospheric nitrogen deposition ● Changes in species distribution
Colne Estuary (Mid-Essex Coast Phase 2) SPA	**Article 4.1 species of importance listed in Annex I** ● During the breeding season: Little Tern (*Sterna albifrons*) ● Over winter the area supports: Avocet (*Recurvirostra avosetta*), Golden Plover (*Pluvialis apricaria*), Hen Harrier (*Circus cyaneus*) **Article 4.2 species of importance not listen in Annex I** ● Dark-bellied Brent Goose (*Branta bernicla bernicla*), Redshank (*Tringa totanus*). The area qualifies by regularly supporting at least 20,000 waterfowl, including: Black-tailed Godwit (*Limosa limosa islandica*), Dunlin (*Calidris alpina alpina*), Lapwing (*Vanellus vanellus*), Grey Plover (*Pluvialis squatarola*), Ringed Plover (*Charadrius hiaticula*), Shelduck (*Tadorna tadorna*), Cormorant (*Phalacrocorax carbo*), Great Crested Grebe (*Podiceps cristatus*).	● Coastal squeeze (pressure and threat) ● Public access/ disturbance (pressure) ● Fisheries: Commercial marine and estuarine (pressure/ threat) ● Planning permission: general (pressure) ● Changes in species distributions (threat) ● Invasive species (pressures and threats) ● Fisheries: Recreational marine and estuarine (pressure) ● Air pollution: Risk of atmospheric nitrogen deposition (pressure)

Site name	Reason for designation	Threats and pressures
Colne Estuary (Mid-Essex Coast Phase 2) Ramsar site	**Ramsar Criterion 1** This site is important due to the extent and diversity of saltmarsh present. **Ramsar Criterion 2** The site supports 12 species of nationally scare plants, including: *Bupleurum tenuissimum, Carex divisa, Frankenia, Hordeum marinum, Inula crithmoides, Limonium binervosum, Sarcocornia perennis, Salicornia pusilla, Spartina maritima, Suaeda vera, Zostera marina, Zostera noltei*.The site contains at least 38 British Red Data Book invertebrate species. **Ramsar Criterion 3** This site supports a full and representative sequence of saltmarsh plant communities covering the range of variation in Britain. **Ramsar Criterion 5** Assemblages of international importance. Species with peak counts in winter: 32041 waterfowl (5-year peak mean 1998/99-2002/2003). **Ramsar Criterion 6** Species/populations occurring at levels of international importance. Winter: Dark-bellied Brent Goose (*Branta bernicla bernicla*), Common Redshank (*Tringa totanus tetanus*). Species identified subsequent to designation for possible future consideration: Black-tailed godwit (*Limosa limosa islandica*).	No information available.
Essex Estuaries SAC	**Annex I habitats that are a primary reason for selection of this site** ● Estuaries ● Mudflats and sandflats not covered by seawater at low tide ● Salicornia and other annuals colonising mud and sand ● Spartina swards (*Spartinion maritimae*) ● Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) ● Mediterranean and thermos-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) **Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site** ● Sandbanks which are slightly covered by sea water all the time **Annex II species present as a qualifying feature, but not a primary reason for site selection** Allis shad (*Alosa alosa*), Twait shad (*Alosa fallax*), Harbour Seal (*Phoca vitulina*).	● Coastal squeeze (pressure and threat) ● Public access/ disturbance (pressure) ● Fisheries: Commercial marine and estuarine (pressure/ threat) ● Planning permission: general (pressure) ● Changes in species distributions (threat) ● Invasive species (pressures and threats) ● Fisheries: Recreational marine and estuarine (pressure) ● Air pollution: Risk of atmospheric nitrogen deposition (pressure)
Blackwater Estuary (Mid-Essex Coast Phase 4) SPA	**Article 4.1 species of importance listen in Annex I** ● During the breeding season: Little Tern (Sterna albifrons). ● Over winter: Avocet (*Recurvirostra avosetta*), Golden Plover (*Pluvialis apricaria*), Hen Harrier (*Circus cyaneus*), Ruff (*Philomachus pugnax*). **Article 4.2 species of importance not listen in Annex I** ● On passage: Ringed Plover (*Charadrius hiaticula*) ● Over winter: Black-tailed Godwit (*Limosa limosa islandica*), Dark-bellied Brent Goose (*Branta bernicla bernicla*), Dunlin (*Calidris alpina alpina*), Grey Plover (*Pluvialis squatarola*), Redshank (*Tringa totanus*), Ringed Plover (*Charadrius hiaticula*), Shelduck (*Tadorna tadorna*). The area qualifies by regularly supporting at least 20,000 waterfowl, including: Great Crested Grebe (*Podiceps cristatus*), Ruff (*Philomachus pugnax*), Dark-bellied Brent Goose (*Branta bernicla bernicla*), Shelduck (*Tadorna tadorna*), Ringed Plover (*Charadrius hiaticula*), Grey Plover (*Pluvialis squatarola*), Dunlin (*Calidris alpina alpine*), Redshank (*Tringa tetanus*), Curlew (*Numenius arquata*), Cormorant (*Phalacrocorax carbo*), Wigeon (*Anas Penelope*), Teal (*Anas crecca*), Pintail (*Anas acuta*), Shoveler (*Anas clypeata*), Goldeneye (*Bucephala clangula*), Red-breasted Merganser (*Mergus serrator*), Lapwing (*Vanellus vanellus*), Black-tailed Godwit (*Limosa limosa islandica*)	● Coastal squeeze (pressure and threat) ● Public access/ disturbance (pressure) ● Fisheries: Commercial marine and estuarine (pressure/ threat) ● Planning permission: general (pressure) ● Changes in species distributions (threat) ● Invasive species (pressures and threats) ● Fisheries: Recreational marine and estuarine (pressure) ● Air pollution: Risk of atmospheric nitrogen deposition (pressure)

Site name	Reason for designation	Threats and pressures
Blackwater Estuary (Mid-Essex Coast Phase 4) Ramsar site	**Ramsar Criterion 1** Qualifies by virtue of the extent and diversity of saltmarsh habitat present. **Ramsar Criterion 2** The invertebrate fauna is well represented and includes at least 16 British Red Data Book species, including: the water beetle (*Paracymus aeneus*), the damselfly (*Lestes dryas*), the flies (*Aedes flavescens, Erioptera bivittata, Hybomitra expollicata*) and the spiders (*Heliophanus auratus* and *Trichopterna cito*) **Ramsar Criterion 3** This site supports a full and representative sequences of saltmarsh plant communities covering the range of variation in Britain. **Ramsar Criterion 5** Assembalges of itnernation importance. Species with peak counts in winter: 105,061 waterfowl (5 year peak mean 1998/99-2002/2003) **Ramsar Criterion 6** Species/populations occurring at levels of international importance. Winter: dark-bellied brent goose (*Branta bernicla bernicla*), Grey plover (*Pluvialis squatarola*), Dunlin (*Calidris alpina alpina*) and Black-tailed godwit (*Limosa islandica*). Species identified subsequent to designation for possible future consideration: Common shelduck (*Tadorna tadorna*), European golden plover (*Pluvialis apricaria apricaria*) and Common redshank (*Tringa tetanus*).	No information available.
Upper Nene Gravel Pits SPA	**Article 4.1 species of importance listed in Annex 1** Internationally important populations supported: ● Over winter - Eurasian bittern (*Botaurus stellaris*), golden plover (*Pluvialis apricaria*). Internationally important populations of regularly occurring migratory species: ● Gadwall (Ana Strepera) **Article 4.2 species of importance not listed in Annex 1** ● Internationally important assemblage of birds Over winter the area regularly supports 23,821 wildfowl, including: *Anas clypeata, Anas penelope, Anas platyrhynchos, Aythya farina, Aythya fuligula, Fulica atra, Phalacrocorax carbo, Podiceps cristatus, Vanellus vanellus.*	● Public access/ disturbance (threat) ● Planning permission: general (threat) ● Fisheries: Freshwater (threat) ● Change in land management (threat)
Upper Nene Gravel Pits Ramsar site	**Ramsar Criterion 5** In the non-breeding season, the site regularly supports 23,831 individual waterfowl. **Ramsar Criterion 6** Site regularly supports 1% of individuals in the populations of the following species in any season: Mute swan (*Cygnus olor*), gadwall (*Anas strepera*).	No information available.
Nene Washes SAC	**Annex II species that are a primary reason for selection of this site** Spined loach (*Cobitis taenia*) - Moreton's Leam, a large drainage channel running along the eastern flank of the Nene Washes, contains the highest recorded density of spined loach in the UK. There may also be thriving populations in the smaller ditches of the Washes. the Nene catchment.	● Hydrological changes (threat) ● Water pollution (threat)
Nene Washes Ramsar site	**Ramsar Criterion 2** Supports an important assemblage of nationally rare breeding birds. Supports a wide range of raptors occur through the year. Supports several nationally scarce plants, and two vulnerable and two rare British Red Data Book invertebrate species have been recorded. **Ramsar Criterion 6** Species/populations occurring at levels of international importance. Winter: Tundra swan (*Cygnus columbianus bewickii*). Species/populations identified subsequent to designation for possible future consideration: Spring/autumn - black-tailed godwit (*Limosa limosa islandica).* Winter - northern pintail (*Anas acuta*).	No information available.

Site name	Reason for designation	Threats and pressures
Nene Washes SPA	**Article 4.1 species of importance listed in Annex 1** Internationally important populations supported: ● Over winter – tundra swan (*Cygnus columbianus bewickii*) **Article 4.2 species of importance not listed in Annex 1** Internationally important populations supported: ● During the breeding season – northern shoveler (*Anas clypeata*), garganey (*Anas querquedula*), gadwall (Anas strepera), black-tailed godwit (Limosa limosa limosa). Over winter – northern pintail (*Anas acuta*), northern shoveler *(Anas clypeata*), Eurasian teal (*Anas crecca*), Eurasian wigeon (*Anas penelope*), gadwall (*Anas strepera*).	● Hydrological changes (threat) ● Water pollution (threat)
Rutland Water Ramsar site	**Ramsar Criterion 5** Assemblages of international importance. Species with peak counts in the winter: 19274 waterfowl (5-year peak mean 1998/99-2002/03). **Ramsar Criterion 6** Species/populations occurring at levels of international importance. Spring/Autumn: Gadwall (*Anas strepera strepera*), northern shoveler (*Anas clypeata*). Species/populations identified subsequent to designation for possible future consideration: Mute swan (*Cygnus olor*).	No information available.
Rutland Water SPA	**Article 4.1 species of importance listed in Annex 1** Internationally important populations supported: ● Over winter: *Anas crecca, Anas penelope, Anas strepera, Aythya fuligula, Bucephala clangula, Cygnus olor, Fulica atra, Mergus merganser, Podiceps cristatus.* **Article 4.2 species of importance not listed in Annex 1** Internationally important populations supported: Over winter the area regularly supports 25037 waterfowl, including - *Anas crecca, Anas penelope, Anas strepera, Aythya fuligula, Bucephala clangula, Cygnus olor, Fulica atra, Mergus merganser, Podiceps crisatus, Anas clypeata.*	● Water abstraction (threat) ● Inappropriate water levels (threat) ● Direct impact from 3rd party (threat) ● Invasive species (threat) ● Water pollution (threat) ● Planning permission: General (threat) ● Public access/ disturbance (threat) ● Fisheries: Freshwater (threat)
Humber Estuary SAC	**Annex I habitats that are the primary reason for site selection** ● Estuaries. Habitats include: ● Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) ● Sandbanks which are slightly covered by sea water all the time ● Mudflats and sandflats not covered by seawater at low tide ● Salicornia and other annuals colonising mud and sand ● Coastal lagoons ● Mudflats and sandflats not covered by water at low tide **Annex I habitats present as a qualifying feature, but not a primary reason for site selection** ● Sandbanks which are slightly covered by sea water all the time ● Coastal lagoons ● Salicornia and other annuals colonizing mud and sand ● Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) ● Embryonic shifting dunes ● Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) ● Fixed coastal dunes with herbaceous vegetation (grey dunes) ● Dunes with *Hippopha rhamnoides* **Annex II species present as a qualifying feature, but not a primary reason for site selection** ● Sea lamprey (*Petromyzon marinus*) ● River lamprey (*Lampetra fluviatilis*) ● Grey seal (*Halichoerus grypus*)	● Water pollution (pressure and threat) ● Coastal squeeze (threat) ● Changes in species distributions (threat) ● Undergrazing (pressure) ● Invasive species (threat) ● Natural changes to site conditions (pressure and threat) ● Public access/ disturbance (pressure) ● Fisheries: Fish stocking (pressure) ● Fisheries: Commercial marine and estuarine (pressure) ● Direct land take from development (threat) ● Air pollution: Impact of atmospheric nitrogen deposition (pressure) ● Shooting/ scaring (pressure) ● Direct impact from third party (threat) ● Inappropriate scrub control (pressure)

Site name	Reason for designation	Threats and pressures
Humber Estuary Ramsar Site	**Ramsar Criterion 1** Includes the following component habitats: Dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes and coastal brackish/saline lagoons. **Ramsar Criterion 3** Breeding colony of grey seals (*Halichoerus grypus*). The dune slacks are the most north-easterly breeding site in Great Britain of the natterjack toad (*Epidalea calamita*) **Ramsar Criterion 5** Supports 153,934 water birds during the non-breeding season **Ramsar Criterion 6** Spring/Autumn: golden plover (*Pluvialis apricaria*), red knot (*Calidris canutus*), dunlin (Calidris alpina), black-tailed godwit (*Limosa limosa*), common redshank (*Tringa tetanus*). Winter: shelduck (*Tadorna tadorna*), golden plover (*Pluvialis apricaria*), red knot (*Calidris canutus*), dunlin (*Calidris alpina*), black-tailed godwit (*Limosa limosa*), bar-tailed godwit (*Limosa lapponica*), redshank (*Tringa tetanus*). **Ramsar Criterion 8** Acts as an important migration route for both river lamprey (*Petromyzon fluviatilis*) and sea lamprey (*Petromyzon marinus*).	No information available.
Humber Estuary SPA	**Article 4.1 species of importance listed in Annex 1** ● Bittern (*Botaurus stellaris*) ● Marsh harrier (*Circus aeruginosus)* ● Hen harrier (*Circus cyaneus*) ● Avocet (*Recurvirostra avosetta*) ● **Golden** plover (*Pluvialis apricaria*) ● Bar-tailed godwit (*Limosa lapponica*) ● Little tern (*Sternula albifrons*) ● Ruff (*Philomachus pugnax*) **Article 4.2 species of importance not listed in Annex 1** ● Shelduck (*Tadorna tadorna)* ● Knot (*Calidris canutus*) ● Dunlin (*Calidris alpina*) ● Sanderling (*Calidris alba*) ● Redshank (*Tringa tetanus*) Over winter, the area regularly supports 187,617 individual waterfowl (5-year peak mean 1991/2 - 1995/6).	● Water pollution (pressure and threat) ● Coastal squeeze (threat) ● Changes in species distributions (threat) ● Undergrazing (pressure) ● Invasive species (threat) ● Natural changes to site conditions (pressure and threat) ● Public access/ disturbance (pressure) ● Fisheries: Fish stocking (pressure) ● Fisheries: Commercial marine and estuarine (pressure) ● Direct land take from development (threat) ● Air pollution: Impact of atmospheric nitrogen deposition (pressure) ● Shooting/ scaring (pressure) ● Direct impact from third party (threat) ● Inappropriate scrub control (pressure)
River Wensum SAC	**Annex I habitats that are a primary reason for selection of this site:** Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. **Annex II species that are a primary reason for selection of this site:** ● White-clawed crayfish (*Austropoamobius pallipes*) **Annex II species present as a qualifying feature, but not a primary reason for site selection:** ● Desmoulin's whorl snail (*Vertigo moulinsiana*) ● Brook lamprey (*Lampetra planeri*) ● Bullhead (*Cottus gobio*)	● Physical modification (pressure) ● Inappropriate weirs, dams and other structures (pressure) ● Siltation (pressure) ● Invasive species (pressure) ● Water pollution (pressure) ● Water abstraction (pressure)
Breckland SPA	**Article 4.1 species of importance listed in Annex I** During the breeding season: ● Nightjar (*Caprimulgus europaeus*)	● Lack of ground disturbance (pressure) ● Undergrazing (pressure)

Site name	Reason for designation	Threats and pressures
	● Stone curlew (*Burhinus oedicnemus*) ● Woodlark (*Lullula arborea*)	● Forestry and woodland management (threat) ● Water pollution (pressure) ● Changes in species distributions (pressure and threat) ● Stone curlew monitoring and intervention (threat) ● Planning permission: General (pressure) ● Monitoring (threat) ● Air pollution: impact of atmospheric nitrogen deposition (threat) ● Public access/ disturbance (threat) ● Climate change (threat) ● Inappropriate scrub control (pressure) ● Inappropriate management practices (pressure) ● Habitat fragmentation (threat) ● Inappropriate weed control (pressure and threat) ● Inappropriate pest control (threat) ● Inappropriate cutting and mowing (pressure)
Breckland SAC	**Annex I habitats that are a primary reason for selection of this site** ● Inland dunes with open *Corynephorus* and *Agrostis* grasslands ● Natural eutrophic lakes with *Magnopotmion* or *Hydrocharition* – type vegetation ● European dry heaths ● Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia* and important orchid sites **Annex I habitats present as a qualifying feature. But not a primary reason for selection of this site** ● Alluvial forests with *Alnus glutinosa* and *Fraxius excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) **Annex I species present as a qualifying feature, but not a primary reason for site selection** ● Great crested newt (*Triturus cristatus*) ● Barbastelle bat (*Barbastella barbastellus*)	● Lack of ground disturbance (pressure) ● Undergrazing (pressure) ● Forestry and woodland management (threat) ● Water pollution (pressure) ● Changes in species distributions (pressure and threat) ● Stone curlew monitoring and intervention (threat) ● Planning permission: General (pressure) ● Monitoring (threat) ● Air pollution: impact of atmospheric nitrogen deposition (threat) ● Public access/ disturbance (threat) ● Climate change (threat) ● Inappropriate scrub control (pressure) ● Inappropriate management practices (pressure) ● Habitat fragmentation (threat) ● Inappropriate weed control (pressure and threat) ● Inappropriate pest control (threat) ● Inappropriate cutting and mowing (pressure)

Site name	Reason for designation	Threats and pressures
Norfolk Valley Fens SAC	**Annex I habitats that are a primary reason for selection of this site** ● Alkaline fens **Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site** ● Northern Atlantic wet heaths with *Erica tetralix* ● European dry heaths Semi-natural dry grasslands and scrubland facies on calcareous substrats (Festuco-Brometalia and important orchid sites) ● Molinia meadows on calcareous, peaty or clayed-silt-laden soils (*Molinion caeruleae*) ● Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* ● Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) **Annex II species that are a primary reason for selection of this site** ● Narrow-mouthed whorl snail (*Vertigo angustoir*) ● Desmoulin's whorl snail (*Vertigo moulinsiana*) **Annex II species present as a qualifying feature, but not a primary reason for site selection** ● Eurasian Otter (*Lutra lutra*) ● Great crested newt (*Triturus cristatus*)	● Inappropriate water levels (pressure) ● Inappropriate scrub control (pressure) ● Hydrological changes (pressure and threat) ● Water pollution (threat) ● Inappropriate cutting and mowing (pressure) ● Water abstraction (pressure) ● Undergrazing (pressure) ● Overgrazing (pressure) ● Invasive species (threat) ● Change in land management (threat) ● Change in species distributions (threat) ● Air pollution: Impact of atmospheric nitrogen deposition (pressure and threat)

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