Drought Plan 2022

Annex 8: Habitats Regulations Assessment Report Part 1 – Stages 1 and 2

Publication date: August 2025

from Southern Water

Contents

PART A – Stage 1 Screening

1 Introduction

1.1 Background and purpose of report

Southern Water Services (Southern Water) has prepared this Draft Drought Plan 2022 and has undertaken a Habitats Regulations Assessment (HRA) of the plan.

Water companies in England and Wales are required to prepare and maintain Statutory Drought Plans under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003, which set out the operational steps a company will take before, during and after a drought. The Water Industry Act 1991 (as amended) defines a Drought Plan 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 under Chapter 3 of Part 2 of the Water Resources Act 1991*'.

A water company must ensure its Drought Plan meets the requirements of the Conservation of Habitats and Species Regulations (Amended) 2017 (hereafter referred to as the Habitats Regulations) before implementation. 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.

Water companies in England are required to produce a Drought Plan every five years and submit a draft plan to the Secretary State in line with the timescales set out in the Drought Plan (England) Direction 2016. The Environment Agency's Drought Plan Guidance[1] specifies that a water company must ensure that its drought plan meets the requirements of the Habitats Regulations. The Environment Agency's 2020 Drought Plan Guidance advises companies to consult the UK Water Industry Research (UKWIR) report 'Strategic Environmental Assessment and Habitat Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans[2] in preparing its HRA. The UKWIR report recommends that all Drought Plans should be subject to the first stage of HRA, i.e. screening for likely significant effects (LSE).

Since our consultation on this draft drought plan in 2021, we have had to make a number of changes to the plan in response to regulatory feedback and we have re-submitted our draft plan to regulators in May 2022, September 2022 and February 2024. Following a letter received from Defra on 21 August 2024 we have made further changes to our draft plan. We have marked changes, except for minor typographic corrections, with yellow fill. For the rest of the plan, we have retained the text as it was.

1.2 Requirement for Habitats Regulations Assessment

The responsibility for undertaking the Habitats Regulations Assessment lies with Southern Water as the Plan making authority.

[1] Environment Agency (2020) Water Company Drought Plan guideline, December 2020.
[2] UKWIR (2012) Strategic Environmental Assessment and Habitats Regulations Assessments - Guidance for Water Resources Management Plans and Drought Plans (WR/02/A)

The requirement for undertaking Habitat Regulation Assessment is provided within the Habitats Regulations. Regulation 63(5) states that the Plan making authority (in this case Southern Water) 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 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).

The UK left the EU on 31 January 2020 under the terms set out in the European Union (Withdrawal Agreement) Act 2020 ("the Withdrawal Act"). The Withdrawal Act retains the body of existing EU-derived law within our domestic law. The most recent amendments to the Habitats Regulations – the Conservation of

Habitats and Species (Amendment) (EU Exit) Regulations 2019 – make it clear that the need for HRA continues notwithstanding departure from the EU.

The HRA process applies the 'Precautionary Principle'[3] to European sites. Plans and projects can only be permitted having ascertained that there will be no adverse effect on the integrity of the international site(s) in question. Plans and projects with predicted adverse impacts on international sites may still be permitted if there are no alternatives to them and there are Imperative Reasons of Overriding Public Interest (IROPI) as to why they should go ahead. In such cases, compensation would be necessary to ensure the overall integrity of the site network.

HRAs will still need to be carried out (at the individual project level) as and when each of the options included in the plan is brought forward by Southern Water and applications are made for the drought order/permits. At that stage, the plan level HRA will need to be revisited to take account of any changes to the proposed option, any construction and operational arrangements, as well as the final package of mitigation measures. In-combination effects will also need to be re-assessed to take account of prevailing, updated, information on other projects, programmes and plans.

1.3 Consultation

Since many of the drought management measures contained within the Drought Plan 2022 were previously included in the adopted Drought Plan 2019, this HRA uses the final HRA for the Drought Plan 2019 as a basis and updates it where necessary to reflect changes in options, baseline information or legislation and guidance.

Natural England and the Environment Agency were informally consulted on the draft methodology for the HRA of the draft Drought Plan 2019 in August 2016. Natural England was informally consulted on the initial outputs of the screening process in December 2016, with further informal consultation with Natural England and the Environment Agency on the HRA during January to March 2017. Comments received from both Natural England and the Environment Agency were considered in preparing the HRA Report for the draft Drought Plan 2019.

Prior to adoption of the Drought Plan 2019 the HRA Report was updated to reflect representations made by Natural England and the Environment Agency during the consultation on Southern Water's draft Drought Plan as well as the agreements reached through the Hampshire Abstraction Licences Public Inquiry process in March-April 2018. This included a Section 20 Agreement being signed between Southern Water and the Environment Agency in relation to the Test Surface Water Drought Permit and Drought Order, Candover Augmentation Scheme Drought Order and the Lower Itchen sources Drought Order. The Section 20 Agreement includes various provisions pertaining to the HRA as discussed further in this report. The HRA also included an Appropriate Assessment of the Darwell Drought Order, reflecting the outcome of discussions held with the Environment Agency and Natural England in November 2018. The analysis underlying these orders and schemes has been retained in this Drought Plan 2022 HRA where appropriate and relevant.

Consultation meetings were held with both Natural England and the Environment Agency regarding the methodologies to be used in the Drought Plan 2019 assessments (August and September 2016 respectively), the screening for each of the assessments (November 2016 – February 2017) and to discuss queries or issues on draft versions of the Environmental Assessment Reports (EARs) (March – April 2017). Subsequent meetings were held with Natural England and the Environment Agency in May 2018 to discuss their

3 The Precautionary Principle, which is referenced in Article 191 of the Treaty on the Functioning of the European Union, has been defined by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2005) as: "When human activities may lead to morally unacceptable harm [to the environment] that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm. The judgement of plausibility should be grounded in scientific analysis".

representations on the draft Drought Plan and how these would be addressed in the revised draft Drought Plan. Further discussions were held with Natural England following submission of the revised draft Drought Plan (June 2018) in updating the EARs and outputs from these discussions, including non-statutory advice provided by Natural England, were incorporated into the HRA Annex for the adopted Drought Plan 2019. These discussions focused on the following drought permit or order options: Lower Itchen sources; Candover; Caul Bourne; Eastern Yar; and Darwell.

For the Drought Plan 2022 HRA specifically, Natural England were notified by email (01/02/21) of the proposed approach to be undertaken for the 2022 HRA, involving retaining the majority of the analysis from the agreed Drought Plan 2019 HRA where still relevant and only making targeted updates to address changes to guidance, legislation and the evidence base.

The HRA has been used to inform production of the updated Strategic Environmental Assessment (SEA) of the Draft Drought Plan 2022 as well as the EARs for each Drought Order/Permit required by Southern Water, and vice versa.

1.4 Structure of the report

The report is divided into the following parts and sections:

Part A – Stage 1 Screening
Section 1: Introduction
Section 2: Methodology
Section 3: The Draft Drought Plan 2022
Section 4: Stage 1 Screening
Section 5: Screening conclusions and recommendations

Part B – Stage 2 Appropriate Assessment
Section 6: Stage 2 Appropriate Assessment

Part C is separate document: *Annex 8 HRA Report Stages 3 and 4*

Part C: Stages 3 and 4 Alternative options, IROPI and compensation measures
Section 7: Stage 3 Consideration of alternative options
Section 8: IROPI
Section 9: Compensation measures

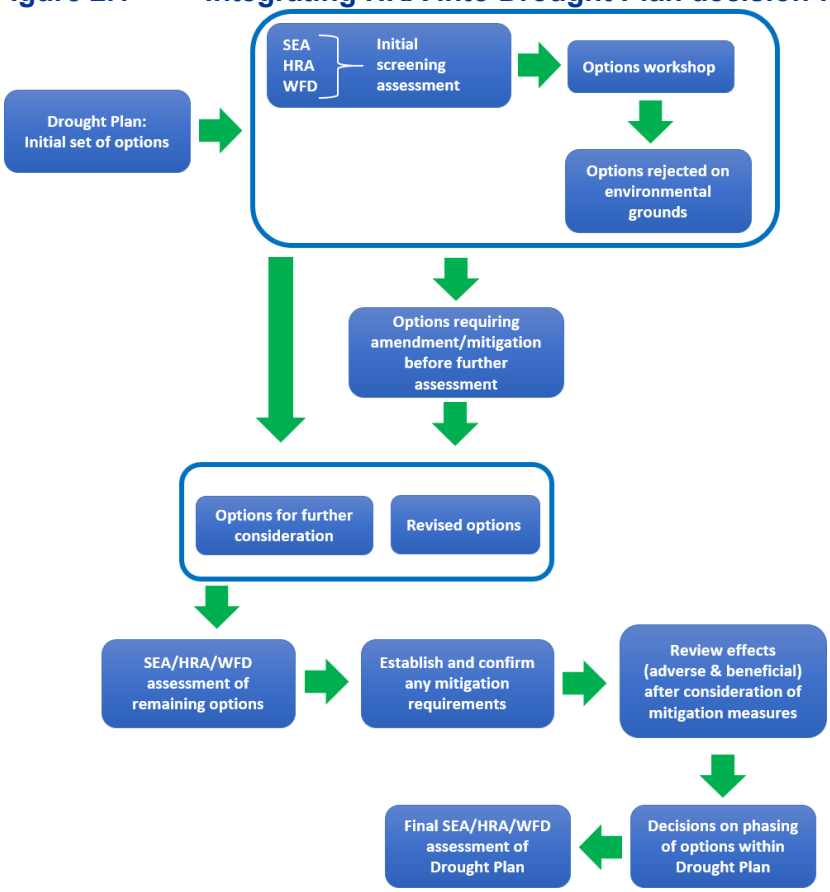
2 Methodology

2.1 Overview

The objective of the HRA is to establish whether measures included in the Draft Drought Plan 2022 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 where likely significant effects cannot be ruled out, adopting the precautionary principle, to determine through Appropriate Assessment whether the option would adversely affect the integrity of the European site(s).

The HRA has been undertaken in parallel with the Strategic Environmental Assessment (SEA) and Water Framework Directive (WFD) assessment to ensure an integrated approach to environmental assessment and has been used to inform the development of the Draft Drought Plan 2022 to ensure its overall compliance with relevant legislation. Figure 2.1 shows the overall process for integrating HRA into the development of the plan.

Figure 2.1 Integrating HRA into Drought Plan decision-making



Four stages of the HRA of Southern Water's Draft Drought Plan 2022 have been carried out:

1. Firstly, a screening process was undertaken to identify whether each drought management measure in Southern Water's Draft Drought Plan 2022 (either alone or in combination with other plans or projects) is likely to have any significant effects on European sites.

2. Where a likely significant effect cannot be ruled out (noting the precautionary principle and the fact that case law has established that mitigation cannot be taken into account in the decision of likely significant effects), an Appropriate Assessment has been undertaken of the drought management measure 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 specific mitigation measures.

3. Where adverse effects could not be ruled out at the Appropriate Assessment stage, alternative options have been examined to avoid any potential significant effects on the integrity of the European site as Stage 3 of the HRA.

4. Stage 4 comprised an assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest, and consideration of compensation measures it has been concluded that the Secretary of State should be asked to determine that the Plan should proceed (this is a decision for the Secretary of State, not Southern Water).

The HRA has been undertaken in accordance with available guidance for England [4,5,6,7] including the broad guidance published by the UK government in 2019[8] and based on the precautionary approach as required under the Habitats Regulations. It follows the staged HRA approach, as discussed above.

The Draft Drought Plan 2022 proposes a number of measures which Southern Water would take to make more water available for supply than is available under normal operating conditions, including through temporary engineering activities and applications for Drought Permits and Drought Orders to abstract more water from the environment. Drought management measures also include demand management options (e.g. enhanced leakage reduction and water use restrictions), although demand management options by their nature pose no mechanism for negative interaction with European sites. The HRA (alongside the Strategic Environmental Assessment and Water Framework Directive assessment of the Final Drought Plan 2019) has helped to inform the development of the Draft Drought Plan 2022, including determining which measures are acceptable for inclusion in the plan and how implementation of selected alternative measures should be phased during a drought.

For each potential drought management measure, the HRA has considered whether there are any likely significant effects (LSE) arising from construction or implementation activities and/or operation of the measure on one or more European sites, including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) (Bern Convention Emerald Network sites) and Ramsar sites:

- SPAs are classified in response to 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 in response to the Habitats Directive (92/43/EEC) and target particular **habitats** (Annex 1) **and/or species** (Annex II) identified as being of European importance.

[4] English Nature (1997) The Appropriate Assessment (Regulation 48) The Conservation (Natural Habitats &c) Regulations, 1994. Guidance Note HRGN1.
[5] English Nature (1997) The Determination of Likely Significant Effect under The Conservation (Natural Habitats &c.) Regulations 1994. Guidance Note HRGN3.
[6] Defra (2012) The Habitats and Wild Birds Directives in England and its seas: Core guidance for developers, regulators & land/marine managers
[7] Tyldesley, D. & Chapman, C. (2021) The Habitats Regulations Assessment Handbook. DTA Publications.
8 https://www.gov.uk/guidance/appropriate-assessment

- The Government expects potential SPAs (pSPAs), candidate SACs (cSACs), compensation habitat and Ramsar sites to be included within the assessment.
- Ramsar sites support **internationally important wetland habitats** and are listed under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention, 1971) and enacted into British law under the National Planning Policy Framework (NPPF).

For ease of reference through this HRA report, these designations are collectively referred to as "European sites", despite Ramsar designations being made at the international level rather than EU level.

The HRA Stage 1 screening process identified whether each potential drought management measure (either alone or in combination with other plans or projects) is likely to have significant effects on European sites. The purpose of the screening stage was to determine whether any part of the plan is likely to have a significant effect on any European site (including areas of compensation habitat, areas of functional land, and the ability for any abstractions to be maintained for the active management of designated sites). This has been judged in terms of the implications of the plan for the conservation objectives of the site (informed by the supplementary advice on the conservation objectives where published), its 'qualifying features' (i.e. those Annex I habitats, Annex II species, and Annex I bird populations for which it has been designated[9], and Ramsar criterion), and any Site Improvement Plan measures. Significantly, HRA is based on a rigorous application of the precautionary principle: where uncertainty or doubt remains, an impact has been assumed, triggering the requirement for Appropriate Assessment of that drought management measure.

The screening stage also included assessment of any in-combination effects that might result from the concurrent implementation of different management measures within the plan itself, or in-combination with other plans, activities and projects, and whether these would adversely affect the integrity of a European site.

Where a likely significant effect has been identified at the screening stage (noting the precautionary principle), the drought management measure was further reviewed by Southern Water to determine whether it should continue to be included in the Drought Plan or be rejected. Where it was decided that the measure needed to be retained to safeguard essential water supplies, an Appropriate Assessment has been undertaken of the measure to determine whether it 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.

Where adverse effects are identified at the Appropriate Assessment stage, Southern Water has again carefully considered whether the measure should be rejected from the Drought Plan at that stage. For the measure to be retained, Southern Water has had to demonstrate that there are no viable alternative options as part of Stage 3 of the HRA process. Stage 4 of the HRA process comprises an assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the measures should be included, and the plan should be approved by the Secretary of State.

2.2 Potential impacts of the drought management measures

To provide an initial indication of those measures more likely to have a significant effect on a European site(s), those drought management measures that are within 10km of a European site were identified. Consideration has also been given to the relative spatial locations of the drought management measures and designated sites within the same surface water and groundwater catchments and/or estuarine system to ensure that any hydrological connectivity over a longer distance that might affect water-dependent sites, qualifying features

[9] Annexes are contained within the relevant EC Directive.

and designated mobile species has been taken into account. GIS data has been used to map the locations and boundaries of each of the European sites in relation to the different drought management measures.

The attributes of the European sites, which contribute to and define their integrity, have been considered with reference to Standard Data forms for SACs and SPAs and Information Sheets for Ramsar sites. An analysis of these information sources has enabled the identification of the site's qualifying features. This information, as well as Article 17 reporting, site conservation objectives, supplementary guidance, Site Improvement Plans and the supporting Site of Special Scientific Interest's favourable condition tables, has been used to identify those features of each site which determine current conservation status, site integrity and the specific sensitivities of the site. Analysis of how potential impacts of the drought management measures may affect a European site has been undertaken using this information.

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). The assessment has considered both construction effects (where applicable) and operational effects of each measure and post operational effects.

In determining the likelihood of significant effects on European sites from any drought management measure, particular consideration has been given to the possible source-receptor pathways through which effects may be transmitted from activities associated with the measures to features contributing to the integrity of the European sites (e.g. groundwater or surface water catchments, air, etc.). **Table 2-1** provides examples of the types of impacts the measures might 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 potential location of each measure 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 the HRA and justification for them are shown in **Table 2-1**.

Table 2-1: Potential impacts of Drought Plan measures on European sites

Broad categories of potential impacts on European sites, with examples	**Examples of operations responsible for impacts *(distance assumptions in italics)***
Physical loss: • Removal (including offsite effects, e.g. foraging habitat) • Smothering	Development of infrastructure associated with scheme, e.g. new or temporary pipelines, transport infrastructure, temporary weirs. Indirect effects from a reduction in flows e.g. drying out marginal habitat. *Physical loss is mostly likely to be significant where the boundary of the scheme extends within the boundary of the European site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated).*
Physical damage: • Sedimentation / silting • Prevention of natural processes • Habitat degradation • Erosion • Fragmentation • Severance/barrier effect • Edge effects	Reduction in river flow leading to permanent and/or temporary loss of available habitat, sedimentation/siltation, fragmentation, etc. *Physical damage is likely to be significant where the boundary of the scheme 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 scheme to the site, such as through hydrological connectivity downstream of a scheme, long shore drift along the coast, or the scheme impacts the linking habitat).*
Non-physical disturbance: • Noise	Noise from temporary construction or temporary pumping activities.

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts *(distance assumptions in italics)*
• Visual presence • Human presence • Light pollution	*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 bird species, it is concluded that noise impacts could be significant up to 1km from the boundary of the European site.* Noise from vehicular traffic during operation of a scheme. *Noise from construction traffic is only likely to be significant where the transport route to and from the scheme is within 3-5km of the boundary of the European site.* Plant and personnel involved in in operation of the scheme. *These effects (noise, visual/human presence) are only likely to be significant where the boundary of the scheme 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).* Schemes which might include artificial lighting, e.g. for security around a temporary pumping station. *Effects from light pollution are only likely to be significant where the boundary of the scheme is within 500m of the boundary of the European site. From a review of Environment Agency internal guidance on HRA and various websites it is considered that effects of vibration and noise and light are more likely to be significant if development is within 500m of a European site.*
Water table/availability: • Drying • Flooding / stormwater • Changes to surface water levels and flows • Changes in groundwater levels and flows • Changes to coastal water movement	Changes to water levels and flows due to increased water abstraction, reduced storage or reduced flow releases from reservoirs to river systems. *These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme 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 scheme extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme is up or down stream from the European site.* Air emissions associated with plant and vehicular traffic during construction and operation of schemes. *The effect of dust is only likely to be significant where site is within or in proximity to the boundary of the European site[10,11]. 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[12].*
Non-toxic contamination: • Nutrient enrichment (e.g. of soils and water) • Algal blooms • Changes in salinity	Changes to water salinity, nutrient levels, turbidity, thermal regime due to increased water abstraction, storage, or reduced compensation flow releases to river systems. *These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the*

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

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts *(distance assumptions in italics)*
• Changes in thermal regime • Changes in turbidity • Changes in sedimentation/silting	*European Site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme 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	Potential for changes to habitat availability, for example reductions in wetted width of rivers leading to desiccation of macrophyte beds due to changes in abstraction or reduced compensation flow releases to river systems. Creation of new pathway of non-native invasive species. *This effect is only likely to be significant where the scheme is situated within the European site or an upstream tributary of the European site (or affects groundwater levels supporting these sites or tributaries)*

2.3 Habitats Regulations Review of Consents

The Review of Consents process for Southern Water's existing abstractions is relevant to some of the measures in Southern Water's draft Drought Plan that involve increasing existing abstraction at licensed water sources while still remaining within the existing abstraction licence limit; the review also provides context where the proposed Drought Order/permit is seeking to exceed the abstraction licence limit.

The Environment Agency's Review of Consents was undertaken by considering all European sites within Southern Water's supply area. The European sites were initially screened to identify all sites with water-dependent habitat within Southern Water's supply area. Those sites that contained water-dependent habitat were then reviewed to assess whether Southern Water abstractions were located within the same groundwater or surface water catchment and therefore could have potential to affect the hydrogeological or hydrological regime of the sites.

Any sites that were in the same catchment as a Southern Water licensed abstraction source were assessed in more detail to determine whether the abstraction would be likely to have a significant effect. The Environment Agency looked in more detail at the sensitivities of the European site to water supply, and at the local hydrology. For example, a European site may be fed by surface water and the abstraction may be downstream, or the abstraction may be from a confined aquifer which could not impact the water supply at the protected site.

A summary of the results of the Review of Consents process, and the licence variations that are being sought following this process, is provided in **Table 2.2**. Only those schemes included within Drought Plan 2022 are included in Table 2.2 below. It should be noted that for some European sites, such as Arun Valley SAC and Ramsar site, more recent water quality information has become available that post-dates the Review of Consents process. Where such data are available, they have been taken into consideration in the Drought Plan 2022 HRA.

2.4 Managed wetlands

The potential impacts of the implementation of a Drought Permit/order on designated sites has been included in the Environmental Assessment Report for each Drought Permit/Drought Order option (see Section 2.5 below). During a drought, it will be important to determine the effect of the implementation of a Drought Permit/order on any abstraction of water required for the conservation of designated sites such as managed wetlands.

At the time of writing the HRA to support the Draft Plan 2019 (upon which this HRA is based), many existing abstractions were exempt from requiring an abstraction licence. These include abstractions that are made for

conservation purposes such as for managed wetlands. Natural England indicated that, following the implementation of the relevant provisions contained in the Water Act of 2003, such exemptions will no longer be in place. Any abstraction after this period will require a licence.

At the time of writing (February 2022), it is not known what exemptions are still in place and what licences have been issued. As such, theses previously unlicensed abstractions for conservation purposes will have been considered as part of the baseline hydrology flow data used in the assessments and the potential effects of drought plan measures have been considered.

Table 2-2 Habitats Regulations Review of Consents: High Priority Sites Stage 4 Decisions

Permission Type	Licence	Sites affected by Abstraction Licences						FINAL STAGE 4 PROPOSED REQUIREMENTS
		River Itchen SAC	Solent Maritime SAC	Solent & Southampton Water SPA	Portsmouth Harbour SPA	Chichester & Langstone Harbours SPA		
Abstraction Licences	Candover Augmentation Scheme - Environment Agency asset and licence	**Yes**						Reduce daily abstraction limit from 36 Ml/d to 5 Ml/d (proposed) between May and August (inclusive); Apply section 20 operating rules - condition use of scheme to trigger flows - near Eastleigh (when flows fall below 198Mld) or when flows near Southampton fall below 194Mld; EA to carry out habitat improvements under Regulation 51(3).
	Lower Itchen sources SW - Southern Water PWS 11/42/22.7/94	**Yes**						Lower Itchen sources SW - Add monthly abstraction limits for June, July, August and September; Apply a Hands-Off Flow condition.
	Lower Itchen sources GW - Southern Water PWS 11/42/22.6/93	**Yes**						Lower Itchen sources GW - Add monthly abstraction limits for June, July, August and September; Apply a Hands-Off Flow condition.
	Caul Bourne - Southern Water PWS 12/101/4/G/8		**Yes**	**Yes**				Time limit licence for 12 years and link to IoW CAMS

2.5 Drought Permit / Order environmental assessment reports

Environmental Assessment Reports (EARs) have been prepared in parallel to the development of the Drought Plan for any Drought Order / Permit sites identified for inclusion in Southern Water's Drought Plan.

The aim of these studies has been to produce environmental reports that have been agreed with the Environment Agency and Natural England such that in the event of a drought, they are readily available for refreshing based on the prevailing drought situation at that time. The environmental studies consider all potentially affected habitats and species including, but not limited to, SACs, SPAs and Ramsar features as well as any Site of Special Scientific Interest (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.

The output from the HRA process has informed the development of the EARs, and in turn, the outputs from the EARs have been used to support the HRA and help to scope any Appropriate Assessments that may be required. Natural England has provided non-statutory advice on a number of the draft EARs that relate to European sites, and where relevant, the HRA has also been updated to reflect this advice.

2.6 Review of potential in-combination effects

In accordance with the requirements of the Habitats Directive, the HRA has considered the in-combination effects of implementing the drought management measures in a worst-case drought, and the in-combination effects with other activities, programmes, plans and projects, that could have an impact on the European sites identified within the HRA. These have included schemes identified in other Southern Water plans (including its Water Resources Management Plan (WRMPs)), neighbouring water company WRMPs and Drought Plans, Environment Agency Drought Plans, major projects being brought forward by Southern Water, other neighbouring abstractions, discharges and land use, and relevant activities and projects in land use and infrastructure plans.

The following plans and projects have therefore been considered in the HRA:

- Inter-option effects within the Southern Water Drought Plan
- Southern Water Resource Management Plan 2019 (WRMP19)
- Other water company WRMP19s and Drought Plans:
  - Affinity Water Southeast
  - Bournemouth Water (part of South West Water)
  - Cholderton and District Water
  - Portsmouth Water
  - South East Water
  - SES Water
  - Thames Water
  - Wessex Water
- Environment Agency National Drought Action Plan
- River Basin Management Plans – Thames River Basin District and South East River Basin District

- Shoreline Management Plans relevant to the Southern Water Drought Plan options
- Canal & Rivers Trust *Putting Water into Waterways* Water Resources Strategy 2015-2020
- Lower Tidal River Arun Flood Management Strategy
- River Medway Flood Storage Areas project

This report has used all publicly available information.

3 The Draft Drought Plan 2022

3.1 Southern Water supply area

Southern Water's supply area

Southern Water provides water supplies to just over 2.4 million customers across an area of 4,450 square kilometres, extending from East Kent, through parts of Sussex, to Hampshire and the Isle of Wight in the west.

Water supplies are predominantly reliant on the transmission and storage of groundwater from the widespread chalk aquifer that underlies much of the region. This extends throughout parts of Kent, Sussex, Hampshire and the Isle of Wight and makes up 70% of the total water supply. River abstractions account for 23% of the water supplies, most notably the Eastern Yar and Medina on the Isle of Wight; the Rivers Test and Itchen in Hampshire; the Western Rother and Arun in West Sussex; the River Eastern Rother and River Brede in East Sussex; and the River Teise, River Medway and Great Stour in Kent. Four surface water impounding reservoirs provide the remaining 7% of water supplies: Bewl Water, Darwell, Powdermill and Weir Wood. The total storage capacity of these four reservoirs amounts to 42,390 million litres. South East Water is entitled to 25% of the available supplies from the River Medway Scheme which incorporates the storage within Bewl Water reservoir.

Despite the South East being one of the driest regions in the UK, rainfall is integral to the maintenance of water supplies. During winter, when most of the effective rainfall occurs, groundwater reserves are recharged naturally through infiltration processes. Rain infiltrates through the soil to recharge the natural storage in the underlying groundwater to support river baseflows for the following year. Annual rainfall averages 730 millimetres across the Southern Water region. Rainfall experienced outside of winter is of less value to groundwater recharge as it is mostly lost to evaporation, plant transpiration or runs off directly into rivers from the land.

Water companies also prepare long-term Water Resources Management Plans (WRMPs) that set out the forecasts of demand and reliable water supply availability, with forecasts calculated at the level of Water Resource Zones (WRZs). The Southern Water region is divided into fourteen WRZs, some of which are interconnected, and these are also applicable to the Drought Plan (**Figure 3.1**). These fourteen WRZs are amalgamated into three larger, sub-regional areas:

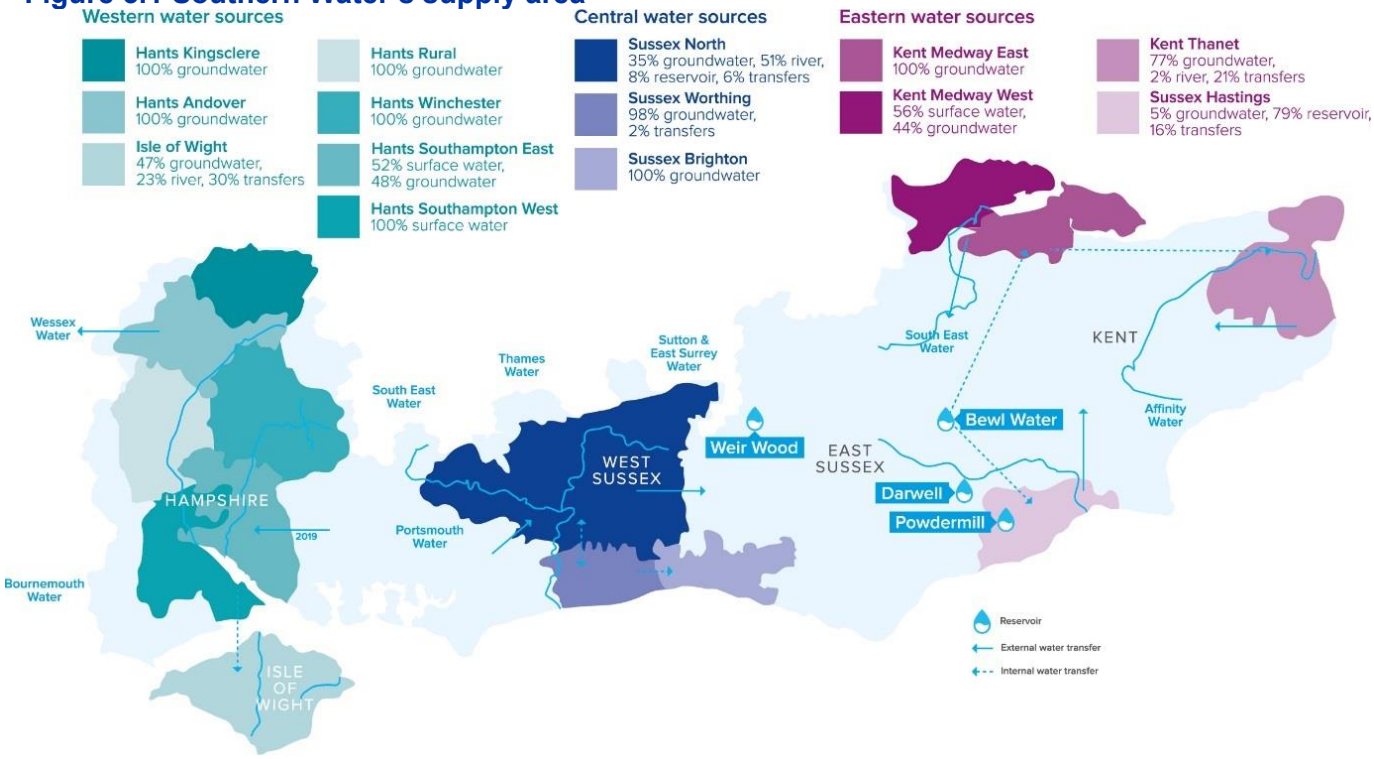
- Western Area – comprising the following seven WRZs:
  - Hampshire Andover (HA);
  - Hampshire Kingsclere (HK);
  - Winchester (W);
  - Hampshire Rural (HR);
  - Southampton East (SE);
  - Southampton West (SW); and
  - The Isle of Wight (IW).
- Central Area – comprising the following three WRZs:
  - Sussex North (SN);
  - Sussex Worthing (SW); and
  - Sussex Brighton (SB).
- Eastern Area – comprising the following four WRZs:

- Medway West (MW);
- Medway East (ME);
- Kent Thanet (KT); and
- Sussex Hastings (SH).

Southern Water's supply area is bounded by eight other water companies (Thames Water; Wessex Water; Cholderton and District Water; South East Water; Affinity Water; SES Water; Bournemouth Water; and Portsmouth Water). A number of bulk water supplies are made between Southern Water and several of these adjacent water companies.

The geographical area under consideration for the HRA covers all of Southern Water's WRZs as well as the river and/or groundwater catchments of those water sources and sources of bulk water supply imports that serve these WRZs, but which lie outside their boundaries.

Figure 3.1 Southern Water's supply area



3.2 Southern Water drought planning process

Overview and timetable

In accordance with the Drought Direction (England) 2016, Southern Water is required to submit an updated Drought Plan to the Secretary of State. The updated plan will guide Southern Water's response to any drought events that may arise in the following 5-year period from 2022 to 2027. The Drought Plan describes the position as it was on consultation in 2021 and is complementary to the WRMP19.

Only those drought management measures which are relevant to the period encompassed by the Draft Drought Plan 2022 are considered in the SEA, WFD and HRA processes. As such several measures that were included in the Drought Plan 2019 and its HRA (such as Sheerness Emergency Desalination) have been deleted from this HRA. In this regard, environmental effects of the potential drought plan measures are

considered within the context of the company's existing abstraction licence conditions (or imminent changes, as indicated) and operating arrangements. Additionally, only those plans, projects and programmes that are likely to be effective during the life of the plan have been considered in the HRA. The closely allied, but separate statutory process, of developing a long-term Water Resources Management Plan (WRMP) is also being undertaken by Southern Water which identifies new permanent measures to address drought resilience over the medium to longer term. Relevant linkages between the two plans (WRMP19 and drought plan) are explained in the draft Drought Plan.

Drought Plan statutory basis

Under sections 39B and 39C of the Water Industry Act 1991 (as amended by the Water Act 2003), water companies are required to prepare and maintain statutory Drought Plans. The Drought Plan sets out the operational steps a water company will take before, during and after a drought to maintain essential water supplies to customers. A Drought Plan is defined by the Water Industry Act 1991 (as amended) 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*". The Drought Plan identifies triggers that act as decision points for implementing a range of drought management actions. The nature of the triggers varies for each Water Resource Zone, and the nature of the drought management actions that will be considered also varies depending on the prevailing drought conditions.

3.3 Southern Water's Drought Plan measures

There are two broad categories of drought management measures: demand-side measures and supply-side measures. These are described below.

Demand-side measures

Demand-side measures are designed to reduce the demand for water in a drought and the options available to Southern Water are summarised in **Table 3-1**. Due to their nature demand-side drought measures do not present negative links to European sites.

Table 3-1 Demand-side drought measures

Measure	Description of Measure
Media campaigns to influence water use	Wide-scale media activity and advertising to encourage voluntary reduction in water usage
Water efficiency promotion to partner organisations	Engage with partner organisations to ensure co-ordinated approach to interventions
Water efficiency promotion with local authorities	Initiate discussions with local authorities regarding watering regimes for public parks and gardens
Leakage reduction	Increase leakage monitoring and repair activity
Pressure management	Mains pressure reduction
Enhanced media campaign with customers	Enhanced media campaign to publicise restrictions and encourage water savings
Temporary Use Ban	Temporary ban on certain categories of water use under water company powers set out in the Water Industry Act 1991 (WIA 1991) as amended by Flood and Water Management Act 2010
Drought Order to ban certain prescribed non-essential water uses	Application to Secretary of State for a Drought Order to prohibit certain prescribed non-essential water uses as set out in the Drought Direction 2011

Measure	Description of Measure
Emergency Drought order to ration water supplies by use of rota cuts or standpipes	Application to Secretary of State for an Emergency Drought Order to authorise water supply via temporary rota cuts or standpipes

Supply-side measures

Supply-side measures are measures available to Southern Water to introduce during a drought to increase the amount of water available for supply. These can pose negative implications for European sites. Those supply-side drought management measures included in the Drought Plan 2022, but which do not require a Drought Order or Drought Permit, are listed **in Table 3-2**.

Table 3-2 Supply-side drought measures not requiring a Drought Permit or Order

Drought Management Measure	Water Resource Zone	Description
Tankering of water	All	Tankering water from adjacent WRZs or other water companies
Rest groundwater sources	Sussex Worthing	Use any spare winter/spring surface water available to supply customers in Worthing and Brighton during the early stages of a drought. This allows groundwater sources in the Worthing area to be rested in key 'storage' sources, which can improve their drought resilience as drought conditions intensify.
Rest groundwater sources	Isle of Wight	Maximise any spare surface water sources available on the Isle of Wight and the cross-Solent supply from Hampshire during the early stages of a drought. This allows groundwater sources in the Isle of Wight to be rested to improve their drought resilience as drought conditions intensify.
Additional import from Portsmouth Water	Hants Southampton East	Increase the bulk import from Portsmouth Water to Southampton East WRZ
Increase bulk imports Reduce bulk water exports	Various	In the event of a severe drought, the Company would investigate the possibility of receiving additional bulk supplies from other water companies and/or reducing existing bulk water exports to other water companies
Rest Weir Wood Reservoir source during early stages of drought	Sussex North	Maximise pumping from the Pulborough source in order to reduce abstraction from Weir Wood Reservoir to conserve reservoir for increased use in the later stages of a drought.
Additional import from Portsmouth Water	Sussex North	Increase import from Portsmouth Water to the Sussex North Water Resource Zone by up to 15 Ml/d
Reduce industrial supply to commercial customer	Hants Southampton West	In the event of a drought the Company would hold discussions with a commercial customer with regards to the possibility of reducing their water supply temporarily.
Reduce supplies to other large commercial customers	Various	In the event of a drought the Company would hold discussions with other large commercial customers as to the possibility of reducing their water supply temporarily.

Supply-side Drought Order / Permit measures

Southern Water may require recourse to Drought Order and/or Drought Permits, allowing temporary modifications to existing abstraction licence conditions or to enable water to be taken from alternative water sources. Drought Orders and Drought Permits are subject to statutory procedures, and may only be granted for specific periods and, subject to limited further renewal. Drought Orders and Drought Permits require environmental monitoring and may require mitigation measures to be in place to address any potential adverse effects. Potential Drought Order / Permit sites are identified in **Table 3.3**.

Table 3-3 Supply side Drought Order/permit measures

Option & Source Type	WRZ	Drought Order/Permit Conditions	Permit/ Order
Lukely Brook WSW Groundwater	IoW	Remove requirement for Minimum Residual Flow condition for the Lukely Brook. Provision of a temporary compensation flow release of 0.4 Ml/d to the Lukely Brook from the groundwater source via a temporary pipeline.	Permit
Caul Bourne WSW Groundwater	IoW	Reduce the Minimum Residual Flow in the Caul Bourne from 4 l/s (0.3 Ml/d) to 2 l/s (0.15 Ml/d) Remove the constraint that limits abstraction to 40 Ml (1.3 Ml/d) within a 30-day period when the flow drops beneath 20 l/s (1.7 Ml/d)	Order
Eastern Yar Augmentation Scheme Surface water	IoW	Reduction to the Minimum Residual Flow conditions: River Medina at Blackwater to reduce from 2.7Ml/d to 1.7 Ml/d. River Medina at Shide: reduce from 5 Ml/d to 4 Ml/d This will allow increased abstraction for transfer and augmentation of flows in the River Eastern Yar.	Permit
Test Surface Water Drought Permit	Hampshire Southampton East & Hampshire Southampton West	Reduce the proposed abstraction licence Hands-Off Flow condition from 355 Ml/d to 265 Ml/d	Permit
Test Surface Water Drought Order	Hampshire Southampton East & Hampshire Southampton West	Reduce the proposed abstraction licence Hands-Off Flow condition from 355 Ml/d to 200 Ml/d. This Drought Order would be required once river flows fall below 265 Ml/d which is covered by the Drought Permit.	Order
Candover Augmentation Scheme Groundwater source	Hampshire Southampton East	Vary the Environment Agency proposed abstraction licence: Hourly limit: 1.125 Ml/hr; Daily limit: 27 Ml/d (but limited to 20 Ml/d between 1st May and 31st August); Annual / 6 monthly limit: 3,750 Ml/yr (an average of 20.8 Ml/d over 6 months) Discharge of the abstracted water: 1) At all times of Drought Order operation, up to 5 Ml/d would be available for environmental flow support to the Candover Stream via the existing Environment Agency pipeline and discharge; 2) Up to 27 Ml/d would be discharged directly to the River Itchen via a new temporary pipeline and discharge facility upstream of the Easton gauging station. Abstraction would be increased over a period of several days up to the full required discharge rate to prevent any sudden increase in flows in the River Itchen; similarly, reductions in discharge would be carried out over a period of day to prevent a sudden decrease in river flow. Abstraction and discharges to the water environment will only be permitted when flows in the River Itchen near Eastleigh are at or below 205 Ml/d.	Order
Lower Itchen Sources Groundwater and Surface water	Hampshire Southampton East	Reduce the proposed abstraction licence Hands-Off Flow condition in the River Itchen near Eastleigh from 198 Ml/d to 160 Ml/d (Southern Water abstraction licence). Reduce the Hands-Off Flow condition in the River Itchen from 194 Ml/d to 150 Ml/d (Portsmouth Water abstraction licence).	Order

Option & Source Type	WRZ	Drought Order/Permit Conditions	Permit/ Order
Pulborough (1) Surface water	Sussex North	Reduce Minimum Residual Flow from 63.65 Ml/d to 53.65Ml/d, allowing greater surface water abstraction from the River Rother.	Permit
Pulborough (2) Surface water	Sussex North	Reduce Minimum Residual Flow from 65.65 Ml/d to 43.65Ml/d, allowing greater surface water abstraction from the River Rother.	Permit
Pulborough (3) Surface water	Sussex North	Reduce Minimum Residual Flow from 65.65 Ml/d to 33.65Ml/d, allowing greater surface water abstraction from the River Rother.	Order
Weir Wood Reservoir Surface water	Sussex North	Reduce statutory compensation flow from Weir Wood Reservoir to the River Medway: From 3.64 Ml/d to 2.5Ml/d in November to April From 5.64 Ml/d to 2.5 Ml/d in May to October.	Order
East Worthing WSW Groundwater	Sussex Worthing	Increase abstraction licence daily limit from 4.5 Ml/d to 7.0 Ml/d between October and December inclusive.	Permit
North Arundel WSW Groundwater	Sussex Worthing	Increase abstraction licence daily limit from 4.5 Ml/d to 7.0 Ml/d.	Order
Bewl Water Reservoir/River Medway Scheme: Stage 1 Surface water	Kent Medway West	In a second dry winter following a dry summer, reduce the Minimum Residual Flow in the River Medway at Teston for abstractions at three locations: From 200 Ml/d in November to January to 150 Ml/d From 250 Ml/d in February to 150 Ml/d From 275 Ml/d in March and April to 150 Ml/d N.B: the Bewl Water Reservoir regulation release factor remains at 1.1	Permit
River Medway Scheme: Stage 2 Surface water	Kent Medway West	In a third dry winter following two successive dry summers, reduce the Minimum Residual Flow in the River Medway at Teston for abstractions at three locations: From 200 Ml/d in November to January to 150 Ml/d From 250 Ml/d in February to 150 Ml/d From 275 Ml/d in March and April to 150 Ml/d Modify the Bewl Water Reservoir regulation release factor from 1.1 to 1.0 to support abstraction from the River Medway at one location.	Permit
River Medway Scheme: Stage 3 Surface water	Kent Medway West	In a third dry summer after three dry winters, reduce the Minimum Residual Flow in the River Medway at Teston for abstractions at three locations: From 350 Ml/d in May to August to 275 Ml/d	Permit

Option & Source Type	WRZ	Drought Order/Permit Conditions	Permit/ Order
		Modify the Bewl Water Reservoir regulation release factor from 1.1 to 1.0 to support abstraction from the River Medway at one location.	
River Medway Scheme: Stage 4 Surface water	Kent Medway West	In the winter following a third dry summer, reduce the Minimum Residual Flow requirement in the River Medway at Teston in relation to abstraction at one of the three locations: From 200 Ml/d in November to January to 0 Ml/d From 250 Ml/d in February to 0 Ml/d From 275 Ml/d in March and April to 0 Ml/d Cease all reservoir regulation release support for abstraction from the River Medway at this location.	Order
Darwell Reservoir (1) Surface water	Sussex Hastings	Reduce the Minimum Residual Flow in the River Rother in June to September from 28.5Ml/d to 18.5Ml/d to allow additional abstraction from the River Rother to Darwell Reservoir.	Order
Darwell Reservoir (2) Surface water	Sussex Hastings	Reduce the Minimum Residual Flow in the River Rother in October to February from 4.545Ml/d to up to 13.2Ml/d to allow additional abstraction from the River Rother to Darwell Reservoir.	Order

We have removed the Sandwich and Faversham drought permits from this table. We have done this because we have recently varied these abstraction licences so that there would no longer be a benefit from these drought permits.

4 Stage 1: Screening

4.1 Screening for Likely Significant Effects of drought management measures

The area covered by Southern Water's Draft Drought Plan 2022, and the SACs, SPAs and Ramsar sites within it are shown on **Figure 4.1**. The SACs, SPAs and Ramsar sites that occur within the study area, as summarised in **Table 4.1**. Those that have been excluded from the HRA Stage 1: Screening, and reasons for doing so, are also described in **Table 4.1**.

Table 4-1 European sites within the study area and inclusion in HRA Stage 1: Screening

Designated Site	SAC	SPA	Ramsar	Inclusion in HRA Stage 1: Screening[13]
Arun Valley	✓	✓	✓	Yes
Ashdown Forest	✓	✓		Yes
Benfleet and Southend Marshes		✓	✓	Yes
Blean Complex	✓			No – the qualifying features of the SAC (9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli*) are not considered to be surface water or groundwater dependent.
Briddlesford Copse	✓			Yes
Duncton to Bignor Escarpment	✓			No – the qualifying features of the SAC (9130 *Asperulo-Fagetum* beech forests) are not considered to be surface water or groundwater dependent.
Dungeness	✓			Yes
Dungeness, Romney Marsh and Rye Bay		✓	✓	Yes
Ebernoe Common	✓			Yes
Emer Bog	✓			Yes
Hastings Cliffs	✓			No – the qualifying features of the SAC (1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts), although defined as water dependent, are not considered to be hydrologically linked to any of the drought options given the distances between them.
Isle of Wight Downs	✓			Yes
Medway Estuary and Marshes		✓	✓	Yes
North Downs Woodlands	✓			No – the qualifying features of the SAC (9130 *Asperulo-Fagetum* beech forests, 91J0 Yew *Taxus baccata* woods on steep slopes and 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)) are not considered to be surface water or groundwater dependent.
Outer Thames Estuary		✓		Yes
Peter's Pit	✓			Yes
Queendown Warren	✓			No – the qualifying features of the SAC (6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)) are not considered to be surface water or groundwater dependent.
River Itchen	✓			Yes

[13] The inclusion of European sites in the HRA Stage 1: Screening included reference to the UK Technical Advisory Group on the Water Framework Directive Guidance on the Identification of Natura Protected Areas [Final] to understand which qualifying features were water dependent.

Designated Site	SAC	SPA	Ramsar	Inclusion in HRA Stage 1: Screening[13]
Sandwich Bay	✓			Yes – the qualifying features of the SAC (2110 Embryonic shifting dunes, 2120 "Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")", 2130 "Fixed coastal dunes with herbaceous vegetation ("grey dunes")", 2170 Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) and 2190 Humid dune slacks), although identified as being water dependent, are considered to be predominantly influenced by coastal and marine processes. However, Natural England have advised that the features in this area are reliant on some freshwater inputs and therefore the designated site has been considered in the screening. As identified in the Site Improvement Plan, the main feature reliant on hydrological changes is the fixed coastal dune with herbaceous vegetation
Solent and Dorset Coast		✓		Yes – this SPA is designated to specifically protect essential foraging areas at sea used by qualifying tern species (common tern, sandwich tern and little tern) of other nearby SPA / Ramsar sites. All three tern species use the open water along the coastline to plunge dive for foraging resources. Although it is considered water flows/resources are not relevant to ensuring a sufficient fish resource for foraging in this SPA it has been assessed for in-combination effects.
Solent and Southampton Water		✓	✓	Yes
Solent Maritime	✓			Yes
South Wight Maritime	✓			Yes The qualifying features of the SAC (1170 Reefs, 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts and 8330 Submerged or partially submerged sea caves), although identified as being water dependent, are considered to be predominantly influenced by coastal and marine processes, rather than temporary changes in surface water and groundwater levels and flows, however could be affected by construction and brine dispersion from emergency desalination options.
Stodmarsh	✓	✓	✓	Yes
Thames Estuary and Marshes		✓	✓	Yes
Thanet Coast	✓			No – the qualifying features of the SAC (1170 Reefs, 8330 Submerged or partially submerged sea caves), although identified as being water dependent, are considered to be predominantly influenced by coastal and marine processes, rather than temporary changes in surface water and groundwater levels and flows.
Thanet Coast and Sandwich Bay		✓	✓	Yes
The Mens	✓			Yes
The Swale		✓	✓	Yes

The HRA has screened all the drought management measures in each of Southern Water's WRZs. The HRA screening matrix for the demand-side measures is provided in **Table 4.2** and for the supply-side measures (excluding Drought Permits/orders) in **Table 4.3**. The HRA screening for the supply-side Drought Order/permit options is summarised in **Table 4.4** below, with the detailed assessments provided in **Appendix A** (restricted document).

Figure 4.1 European sites within the study area and location of Drought Permit / Order options

[Map redacted for security reasons]

Table 4.2 Screening of demand-side drought management measures for likely significant effects on European sites

Option	Likely Significant Effect and Potential for Alteration of Measure to Avoid Effects?	Further HRA Assessment Required?
Water efficiency campaigns and customer communications	None – media/water efficiency campaign are designed to help reduce demand for water and as such no impacts on designated sites are anticipated, other than to acknowledge that decreased demand will have a net positive effect due to reduced pressure on water resources and reduced abstraction at source.	**No**
Leakage reduction and pressure management	None - it is envisaged that leakage detection and repair schemes will largely be undertaken in urban areas with no likely significant effects on designated sites. It is acknowledged that decreased leakage will have a net positive effect due to reduced pressure on water resources and reduced abstraction at source.	**No**
Temporary Use Ban	None – statutory restrictions on customer water use are demand management measures and as such, are not anticipated to have impacts on European sites. It is acknowledged that decreased customer demand will have a net positive due to reduced pressure on water resources and reduced abstraction at source.	**No**
Drought Order ban on non-essential water use	None – a non-essential use ban and its components are demand management measures and as such are not anticipated to have impacts on European sites. It is acknowledged that decreased customer demand will have a net positive effect due to reduced pressure on water resources and reduced abstraction at source.	**No**
Emergency water use restrictions	None – an emergency Drought Order includes extreme demand management measures and as such are not anticipated to have impacts on European sites. It is acknowledged that decreased customer demand will have a net positive effect due to reduced pressure on water resources and reduced abstraction at source.	**No**

For the following drought management measures included in Drought Plan 2022, the HRAs carried out concluded that likely significant effects could not be ruled out and therefore Stage 2 Appropriate Assessments were required to assess the implications of the option on the site's conservation objectives and understand whether the site's integrity could be affected (full details of the likely significant effect decision is contained in Appendix A):

- Lower Itchen sources Drought Order – River Itchen SAC.
- Candover Augmentation Scheme Drought Order – River Itchen SAC.
- River Test Drought Permit
- Caul Bourne WSW Drought Permit – Solent Maritime SAC, Solent and Southampton Water SPA and Ramsar.
- Eastern Yar augmentation scheme Drought Permit – Solent and Southampton Water SPA and Ramsar.
- Darwell reservoir Drought Order – Dungeness, Romney Marsh and Rye Bay SPA and Ramsar.

Table 4.3 Screening of supply-side drought measures not requiring a Drought Permit or order for likely significant effects on European sites

Supply Augmentation Option	Assessment of Likely Significant Effect (LSE) and Potential for Alteration of Measure to Avoid Effects	Further HRA Assessment Required?
Tankering of water	No LSEs to any designated sites are anticipated. Abstractions to support tankering would be from existing sources and within existing abstraction licence conditions that have previously been reviewed as part of the Environment Agency's Review of Consents process and determined not to have any likely significant effects on European sites.	No
Additional import from Portsmouth Water to Hampshire Southampton East and Sussex North Water Resource Zone	No LSEs to any designated sites anticipated as abstractions to support these imports are from existing sources and within existing abstraction licence conditions that have previously been reviewed as part of the Environment Agency's Review of Consents process and determined not to have any likely significant effects on European sites. Note: the Lower Itchen sources Drought Order comprises the combined measures to temporarily reduce the hands-off flow conditions that control abstraction by Portsmouth Water and Southern Water. This Drought Order will enable the Portsmouth Water bulk import to continue in times of severe drought conditions.	No
Changes to Existing Operations:		
Rest groundwater sources – Isle of Wight	As this is an operational change within existing licences and no construction activities are required to implement, no LSEs to any designated sites are anticipated.	No
Rest groundwater sources – Sussex Worthing	As this is an operational change within existing licences and require no construction activities to implement, no LSEs to any designated sites are anticipated.	No
Rest Weir Wood reservoir	As this is an operational change within existing licences and no construction works are required to implement, no LSEs to any designated sites are anticipated.	No

Table 4.4 Screening of Drought order/permit options for likely significant effects on European sites[14,15]

European Sites		Drought Order/Permits										
		Western area						Central area			Eastern area	
		Lukely Brook	Caul Bourne	Eastern Yar Augmentation Scheme	Test Surface Water#	Candover Augmentation Scheme	Lower Itchen Sources	Pulborough (Surface water)*	Weir Wood	North Arundel	Darwell	River Medway Scheme
Arun Valley	SAC											
	SPA											
	Ramsar											
Ashdown Forest	SAC											
	SPA											
Briddlesford Copse SAC												
Dungeness SAC												
Dungeness, Romney Marsh and Rye Bay	SPA											
	Ramsar											
Ebernoe Common SAC												
Emer Bog SAC												
Isle of Wight Downs SAC												
Medway Estuary and Marshes	SPA											
	Ramsar											
Mottisfont Bats SAC												
Peter's Pit SAC												
River Itchen SAC												
Singleton and Cocking Tunnels SAC												
Solent and Dorset Coast SPA												
Solent and Southampton Water	SPA											
	Ramsar											
Solent Maritime SAC												
Stodmarsh	SAC											
	SPA											
	Ramsar											
South Wight Maritime	SAC											
Thames Estuary and Marshes	SPA											
	Ramsar											
Thanet Coast and Sandwich Bay	SPA											
	Ramsar											
Sandwich Bay SAC												
Thanet Coast SAC												
The Mens SAC												
The Swale	SPA											
	Ramsar											
The Swale Estuary Marine Conservation Zone												

Drought Permit and Drought Order options

[14] East Worthing has been screened out completely as no designated sites are within 10km of the abstraction, or subject to an impact pathway.
[15] The full assessments for the screening are provided in Appendix A (restricted document).

We have removed the Sandwich and Faversham drought permits from this table. We have done this because we have recently varied these abstraction licences so that there would no longer be a benefit from these drought permits.

* LSE of Pulborough surface water drought permit/order has been updated to reflect 2023 site specific HRA.

Key:

No proximity or linkage between Drought Permit/Order with the European site	
No Likely Significant Effects determined from 2023 HRAs	
Stage 2 Appropriate Assessment required	

4.2 Potential in-combination effects of the drought management measures

A number of drought management options could be implemented at a similar time, should they be required, and therefore an assessment has also been completed to determine the potential for likely significant in-combination effects, as detailed in **Table 4.5**.

In-Combination Assessment

An-combination assessment, with other relevant plans and projects, has been undertaken for the proposed drought measure), according to the steps below:

Step 1 – Consider whether the proposed scheme has any discernible effects on the European site. If no, then an in-combination assessment is not required.

- **Step 2** - Consider whether the proposed scheme has any adverse effects on the European site when considered in isolation? If yes, then an in-combination assessment is not required, as consent for the proposed scheme cannot be granted unless the HRA Stages 3 and 4 derogation tests are met, in which case all residual effects of the scheme acting alone will be compensated for.
- **Step 3** – Does the proposed scheme have a discernible effect on the European site, but one which is not 'significant' in the context of the Habitats Regulations (i.e., adverse effect on site integrity) alone? If so, then an in-combination assessment is required.
- **Step 4** – Identify the other plans/ projects relevant to the European site, which also have discernible effects that are not an adverse effect alone but may act in combination with the adverse effects of this proposed scheme. It is normal practice to agree this list of potential in-combination plans/projects with the CA (competent authority) before undertaking the assessment.
- **Step 5** – Assess these other plans/ projects in combination with this proposed scheme.

By following the steps above, any potential adverse effects of the proposed scheme in isolation should not be considered within the in-combination assessment, as these adverse effects should be managed and mitigated within the scope of the proposed scheme in question. Only when those effects are considered to be potentially adverse when acting in combination, should they be included. Equally, in accordance with best-practice guidance, any projects or plans which have been previously completed, consented and/or implemented are considered to be part of the existing baseline (and should have been subject to their own HRA before being consented and implemented). Therefore, these will not be included as part of any in-combination assessment for this proposed scheme, but any ongoing operational effects will be noted as part of the baseline environment.

Table 4.5 Screening of in-combination likely significant effects of Southern Water's drought management measures on European sites

Drought Management Measure	In-combination With	European Site	Assessment	In-Combination likely significant effects?
River Medway Scheme	Weir Wood Reservoir	Medway Estuary and Marshes SPA and Ramsar	Due to intervening flows from the River Medway catchment downstream of Weir Wood reservoir, impacts of the Weir Wood Reservoir Drought Order are sufficiently ameliorated before the confluence with the River (Greater) Teise near Maidstone, where in-combination impacts with the River Medway Scheme Drought Permit/order options could occur. As the impacts from the Weir Wood Reservoir Drought Order have not extended further downstream of the confluence with the River (Greater) Teise, no LSEs in-combination with the River Medway Scheme option are anticipated.	No
		Peter's Pit SAC	Supplementary advice to the conservation objectives states that the maintenance of water within the ponds on the SAC site is controlled by groundwater levels. As the impacts resulting from the River Medway Scheme and Weir Wood Reservoir Drought Permit/order options will be confined to the River Medway surface water bodies, no LSEs are anticipated.	No
		Thames Estuary and Marshes SPA and Ramsar	Both Drought Permit/order options affect the River Medway which discharges to the Medway estuary which is downstream of the Thames Estuary and Marshes SPA and Ramsar. No in-combination LSEs are anticipated.	No
North Arundel WSW	East Worthing WSW	None	No in-combination LSEs possible as East Worthing WSW impacts are not within 10km of any designated site nor has it any impact pathways or hydrological connectivity to any designated European site.	No
North Arundel WSW	Pulborough Surface water	Arun Valley SAC, SPA and Ramsar	The North Arundel Drought Order has negligible impacts on flows in the Lower River Arun, downstream of the Arun Valley SAC, SPA and Ramsar. No impacts were identified as a result of the Pulborough Drought Order on the designated sites given the limited connectivity between the habitats and the river due to the presence of the flood banks. Therefore in-combination LSEs are not anticipated.	No
Lukely Brook, Caul Bourne, Eastern Yar (Blackwater), Candover, Lower Itchen and Test		Solent Maritime SAC, Solent and Southampton Water SPA, Solent and Southampton Water Ramsar and Solent and Dorset SPA	There are many areas of estuary and transitional waters located within the wider Solent that contribute to the various environment designations of the European sites. By reviewing the potential impacts of lower freshwater inputs (with water quality & geomorphology) into the relevant areas an in-combination effect of drought permits/orders has been made for the Solent EDS. Due to the separation and isolation of hydrology for freshwater across the Solent between the Mainland (Candover, Itchen and Test) with Isle of Wight (Lukely Brook, Caul Bourne and	Yes

Drought Management Measure	In-combination With	European Site	Assessment	In-Combination likely significant effects?
			Eastern Yar (Blackwater) these are presented separately below, with explanation of approach for all in Section 6.7 Appropriate Assessment.	
Candover Augmentation Scheme	Lower Itchen sources	River Itchen SAC	The two Drought Order options influence the hydrology River Itchen SAC. In the absence of mitigation measures being considered as part of the Stage 1 screening process, it is not possible to screen out the potential for in-combination effects. There remains some uncertainty with regards to the absolute impact on the river flow regime as a result of the operation of the Drought Order, in particular the in-combination effects with public water supply groundwater abstractions from the same chalk aquifer on white-clawed crayfish, Southern damselfly and Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.	Yes
		Solent Maritime SAC	Although there is no direct hydrological connectivity between the groundwater drawdown in chalk aquifer and Solent Maritime SAC compartments further consideration has been given of the in-combination operational effects on water flows and water quality within Southampton Water with SWS's other drought permits/orders. For the Solent Maritime SAC consideration was given to freshwater sources maintaining the natural freshwater flow / volume into the estuary.	Yes
		Solent and Southampton Water SPA and Ramsar	There is a minor theoretical pathway for impact on bird species, floral species and habitats further consideration has been given of the in-combination operational effects on water flows and water quality within Southampton Water with SWS's other drought permits/orders. For the SPA and Ramsar consideration was given to water quality for dissolved oxygen and nutrients.	Yes
Lower Itchen sources	Candover and Test	River Itchen SAC	The main concerns pursuant to the Lower Itchen Drought Orders are that the abstraction at low flow could impact on adult salmon (1106 Atlantic salmon Salmo salar) entering the river from the estuary, adult upstream migration, critical temperatures and dissolved oxygen levels for all life-cycle stages and macroinvertebrate food sources. With operation of both the Test Surface Water drought permit and the Lower Itchen Drought Orders Atlantic salmon has been brought forward for in-combination effects assessment.	Yes
		Solent Maritime SAC	The River Itchen itself does not support any areas of the Solent Maritime SAC, the closest area being within Southampton Water however further consideration has been given of the in-combination operational effects on water flows and water quality within Southampton Water with SWS's other drought permits/orders. For the	Yes

Drought Management Measure	In-combination With	European Site	Assessment	In-Combination likely significant effects?
			Solent Maritime SAC consideration was given to freshwater sources maintaining the natural freshwater flow / volume into the estuary.	
		Solent and Southampton Water SPA and Ramsar	Further consideration has been given of the in-combination operational effects on water flows and water quality within Southampton Water with SWS's other drought permits/orders. For the SPA and Ramsar consideration was given to water quality for dissolved oxygen and nutrients.	Yes
Test Surface Water Drought Permit and Drought Order	Lower Itchen sources	River Itchen SAC	Potential effects on Atlantic salmon (designated feature of the River Itchen SAC) between the concurrent implementation of these two drought orders was considered and evidence prepared by fish experts as part of the Hampshire Abstraction Licences Public Inquiry. The July 2024 project level HRA for the Test Surface Water Drought Permit found that for "the River Itchen SAC, the assessment concludes that adverse effect on integrity cannot be excluded with certainty, at this juncture, with the various mitigation measures, as proposed. *	See commentary below table
Lukely Brook	Caul Bourne, Eastern Yar River Medina at Blackwater	Briddlesford Copse SAC	Through the Review of Consents work the Environment Agency identified two buffer zones used by the Beckstein's bat to feed. The River Medina watercourse flows within the buffer zones. The review of consents work identified each water dependent habitat used by the bats to feed however the River Medina was not in direct hydraulic contact with these particular feeding habitats. The changes to levels and flows in the River Medina resulting from the operation of Lukely Brook with in-combined operations are unlikely to affect the bat species. As such no LSEs are anticipated.	No
		Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar	The Zone of Influence study (Section 3.2 of Lukely Brook HRA) describes that the likely percentage reductions would result in a negligible impact contribution on the freshwater influx to the Medina Estuary due to low percentage of freshwater contribution. Additionally, the abstraction licence permits abstraction if water is still flowing over the Sheep Dip Wash and under the Drought Permit (DP) 0.4Ml/d compensation flow is provided to Lukely Brook, resulting in higher flows during DP to the lower reaches than would be maintained under existing licence conditions. It is not considered likely that the DP will impact the natural transitions from river to sea and upper to lower shore. The screening process has concluded that the DP will not result in an LSE Effect on the interest features of the Solent Maritime SAC, the Solent and Southampton Water SPA, the Solent and Southampton Water Ramsar	No

Drought Management Measure	In-combination With	European Site	Assessment	In-Combination likely significant effects?
Caul Bourne	Lukely Brook, Eastern Yar River Medina at Blackwater,	Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar	During low flows the contribution from the Tertiary deposits in the lower parts of the river are similar magnitude to the Chalk groundwater. With much lower water levels, base flow from the chalk reduces and no longer is continuity with the stream bed. Therefore, the drought permit may prolong recovery time of groundwater levels that contribute to baseflow to stream again (but in timescale of months) The Caul Bourne Mill utilises a mill pond that is in direct continuity with the river. During periods of low flows, the pond dam reduces amount of water flowing downstream. When Mill is operational surges of freshwater are released (freshets), but when freshets are absent during high tides the extent of the saline water extends further upstream (inland) in the estuary and changes the area of transitional water salinity zones. Less water flowing into estuary may also impact wetting zones at edges.	Yes
Eastern Yar augmentation, River Medina at Blackwater	Lukely Brook and Caul Bourne	Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar	The three Drought Order/Permit options affect two different estuaries within the overall SAC: Eastern Yar Augmentation Scheme and Lukely Brook Drought Order/Permit options impact the Medina Estuary whilst the Caul Bourne Drought Permit impacts the Newtown Estuary. The operation of the augmentation scheme reduces flow in the River Medina, as surface water is moved via a pipe to augment flows of the Eastern Yar and impacts arise predominantly from changes in residual freshwater flow and associated impacts on rates of saline intrusion, changes in rates of deposition (e.g., around mudflats and sandbanks), changes in sediment composition and characteristics, changes in water quality and localised changes in vegetation community structure and zonation. The salinity regime in the transitional water maybe impacted and therefore impact the habitats supporting the bird species, and the invertebrate communities the bird species feed on.	Yes

* When we submitted our draft plan in February 2024, there were still ongoing discussions with environmental regulators on the conclusions of the Test drought permit/order HRA and the environmental impacts of this, especially those around Atlantic salmon. We said then that we would update this plan level HRA if conclusions of the permit level HRA changed, and we have done so. The July 2024 project level HRA Appropriate Assessment (AA) for the River Test Drought Permit concluded that there was no likely significant effect for

all European sites except for the River Itchen SAC. It found that for "*the River Itchen SAC, the assessment concludes that adverse effect on integrity cannot be excluded with certainty, at this juncture, with the various mitigation measures, as proposed. Further discussion with the EA on the mitigation measures is welcomed to progress this assessment*."

These ongoing discussions with regulators relating to the River Test surface water drought permit project level HRA indicated that the EA did not consider the mitigation proposed to be sufficient to prevent any potential adverse effects. Adopting the precautionary principle in relation to what may be functionally linked habitat, we have decided that this project level HRA will now progress to stage 3 and, if required, stage 4 of the HRA process. We wrote to the EA on 21 November 2024 to confirm this decision. This is part of the 'application ready' principles that we adhere to should such a drought option be needed in the future.

This process will need to be finalised before any River Test Drought Permit can be granted and implemented. We are currently expecting to conclude this process by summer 2025 and set out an indicative timeline for the process in table 4-7 of the main drought plan report. We shared this indicative timeline with the EA in December 2024. We will update the EA on the latest position with the project level HRA via the annual review process however we do not expect this ongoing process with the project level HRA to impact upon the finalisation of this drought plan.

4.3 Potential in-combination effects with other plans and projects

Southern Water's supply area is bounded by eight other water companies (Thames Water; Wessex Water; Cholderton and District Water; South East Water; Affinity Water – South East; SES Water; Bournemouth Water (part of South West Water); and Portsmouth Water). A number of bulk water supplies are made between Southern Water and several of these adjacent water companies.

Potential in-combination effects with other relevant activities, plans and projects (as described in Section 2.5) have been reviewed and are summarised in this section.

Southern Water Resource Management Plan 2019

Southern Water published its Water Resource Management Plan 2019 (WRMP19) in December 2019.

The scope for in-combination effects of the WMRP19 with the drought management measures included in the Draft Drought Plan 2022 is limited as in most cases the drought management measures will come into operation once the operation of the WRMP schemes has ceased due to abstraction licence conditions. However, the following potential in-combination effects were identified and assessed in relation to specified European sites:

Solent Maritime SAC, Solent and Southampton Water SPA and Ramsar plus Solent to Dorset Coast SPA

The Solent Maritime SAC, Solent and Southampton Water SPA and Ramsar sites, and the Solent to Dorset Coast SPA are located within the hydrological zone of influence of seven Drought Order/Permit options: Lukely Brook, Eastern Yar Augmentation Scheme, Caul Bourne, Candover Augmentation Scheme, Test Surface Water and Lower Itchen Sources options and the following WRMP19 schemes:

- Test Estuary WwTW industrial reuse scheme.
- Sandown WwTW indirect potable reuse scheme
- Import from Bournemouth Water

The WRMP19 Sandown indirect potable reuse schemes are not expected to be completed until 2027 at earliest and therefore the operation of these schemes may overlap with the final year of the Drought Plan timeframe of 2022 to 2027. Construction activities for this scheme will take place during the lifetime of the Drought Plan. However, the Sandown emergency desalination plant construction activity and operational abstraction will take place on the south-eastern coastline of the Isle of Wight which is geographically remote from the European sites that may be affected by the three Isle of Wight drought measures.

This section no longer includes information about Fawley desalination plant because it is no longer being built.

The Test Estuary WwTW industrial reuse scheme is forecast to be operational by 2023. In-combination impacts on the above listed European sites from operation of this scheme and the Drought Plan measures are considered unlikely given (a) the volumes of water in Southampton Water relative to the combined abstractions under the Drought Plan options and WRMP scheme; (b) the hydrographic regime of Southampton Water and the Solent; and (c) the spatial distance between most of the options which are located on different

estuaries/coastlines draining to the Solent/Southampton Water as applicable. Cumulative effects will however arise in spatial proximity between the Test Surface Water Drought Permit or Drought Order and the Test Estuary WwTW industrial water reuse scheme on flows from the Test Estuary to Southampton Water, but the relative reduction in flow arising from these schemes compared to the hydrographic regime and volume of water in Southampton Water is not considered to lead to any likely significant effects on these European sites.

The WRMP19 Bournemouth Water import scheme (abstraction from the Hampshire River Avon and new pipeline to Hampshire Southampton West Water Resource Zone) is anticipated to be implemented in the 2025 to 2030 period, subject to infrastructure improvements and a detailed feasibility study in the 2020 to 2025 period. As the detailed feasibility study is not yet available, a detailed assessment is not possible at this time.

River Itchen SAC

The River Itchen SAC is within the zone of influence of two Drought Order options (Lower Itchen Sources and Candover Augmentation Scheme) and WRMP19 schemes to further increase bulk supplies from Portsmouth Water and works to provide greater supply interconnections within south Hampshire. The only potential effects of the WRMP19 schemes on the SAC is during construction work to lay pipelines but there will not be any likely cumulative effects on the SAC with these Drought Orders.

The WRMP scheme for carrying out in-stream river restoration works on the Lower Itchen will have cumulative beneficial effects with the Lower Itchen Drought Order and Candover Drought Order options on the River Itchen SAC.

Arun Valley SAC, SPA and Ramsar

The Arun Valley SAC, SPA and Ramsar is within the zone of influence of two drought management options (Pulborough Surface water and North Arundel Drought Permits/Orders) and two WRMP19 schemes: the Pulborough winter transfer scheme and the Littlehampton water reuse scheme. The WRMP19 schemes are not expected to be completed until 2027 at earliest and therefore operationally do not overlap with the Drought Plan timeframe of 2022-2027. Consequently, there is no potential for cumulative effects during the lifetime of the Drought Plan; the potential for cumulative effects will be further reviewed as part of the next Drought Plan update.

On 16/12/19 Natural England issued a letter to Southern Water setting out their concerns regarding the existing Pulborough boreholes and Groundwater licence and the drawdown effect they were having on some of the ditches of Arun Valley SAC and Ramsar site. These boreholes do not constitute a drought measure for Drought Plan 2022. However, in meetings with Southern Water in advance of preparation of Drought Plan 2022 Natural England identified the need to consider the potential for any in combination effects between the Pulborough Surface water drought measures (which involve increased abstraction from the River Rother, which drains to the River Arun) and the Pulborough boreholes. The Drought Plan 2019 HRA stated that '… *due to the embanked nature of the River Arun, impacts on the majority of drainage ditches associated with the SPA are unlikely to arise* [from the Rother abstraction]. *During consultation with Natural England (December 2016), the underlying SSSI sites and their connectivity with the River Arun were discussed. It was confirmed that Pulborough Brooks SSSI and Amberley Wild Brooks SSSI were not connected to the River Arun due to the presence of the flood banks along the River Arun'*. Pulborough Brooks and Amberley Wild Brooks are the two SSSIs that Natural England are concerned about regarding the groundwater abstraction at Pulborough. In comments that Natural England provided to

Southern Water in 2018 on the Drought Plan 2019 HRA it was noted that '… *should the review of flood bank management in the Arun Valley result in a change to the current hydrological system this must be taken into account in future drought and resilience planning'*. At time of writing this Drought Plan 2022 HRA there is no published information indicating that the role of the flood banks in separating the River Arun from the two SSSIs will change during this Drought Plan period (to 2027).

Regarding any connection between the Pulborough boreholes and Waltham Brooks SSSI the Natural England letter of 16/12/19 states that ''*Further bore hole logs have recently been provided to Natural England (12/12/19)* [that] *show that the clay extends much further than shown on BGS maps and therefore connectivity to the Folkstone beds at Waltham Brooks has been ruled out. Consequently, Natural England agrees a likely significant effect on Waltham Brooks part of the international sites* [from the Pulborough boreholes] *has been excluded on the basis of objective evidence'.* As such there will be no in combination effect between the River Rother surface water abstraction and the Pulborough boreholes on Waltham Brooks SSSI.

It can therefore be concluded that there will be no in combination likely significant effect between the Pulborough Surface water drought measures and the Pulborough boreholes.

Medway Estuary and Marshes SPA and Ramsar

The Medway Estuary and Marshes SPA and Ramsar are within the hydrological zone of influence of three Southern Water Drought Order/Permit options (Faversham sources*, Weir Wood Reservoir, River Medway Scheme) together with the WRMP19 Medway reuse scheme (joint Southern Water and South East Water proposed scheme). No cumulative effects will arise during construction of the reuse scheme with construction and/or operation of the emergency desalination plant.

* We have removed the Sandwich and Faversham drought permits from this Drought Plan. We have done this because we have recently varied these abstraction licences so that there would no longer be a benefit from these drought permits.

Consequently, no likely significant cumulative effects on the SPA or Ramsar site are anticipated.

Other water company drought plans

Assessment of the potential for in-combination impacts of drought plan supply augmentation measures with drought management measures listed in neighbouring water companies' drought plans has been undertaken.

It should be noted that drought plans of other water companies are subject to review on timescales that may not be aligned with the timescale of Southern Water's Drought Plan. The information used to carry out these assessments is considered to be the most up to date information available, and the conclusions were reviewed against the revised draft drought plans where available.

4.3.1.1 Affinity Water South East Drought Plan

Affinity Water South East's Drought Plan concluded that there were no European sites within the supply area, or near the boundaries of the supply area, that would be impacted by the drought plan options. Therefore, no in-combination impacts with Southern Water's Drought Plan have been identified and no LSEs anticipated.

4.3.1.2 Bournemouth Water (part of South West Water) Drought Plan

Bournemouth Water's Drought Plan only considers implementing measures to reduce demand (e.g. media campaigns, temporary ban on water use, leakage reduction). Consequently, no European sites would be adversely impacted by the plan, and as such, no LSEs with Southern Water's Drought Plan are anticipated.

4.3.1.3 Cholderton and District Water Company Drought Plan

The Cholderton and District Water Company Drought Plan only considers measures to reduce demand (e.g. media campaigns, temporary ban on water use, leakage reduction). Consequently, no European sites would be adversely impacted by the plan, and as such, no LSEs with Southern Water's Drought Plan are anticipated.

4.3.1.4 Portsmouth Water Drought Plan

Portsmouth Water may need to apply for a Drought Permit for its "Source S" groundwater source. This could have combined impacts with Southern Water's North Arundel Drought Order on the Arun Valley SAC, SPA and Ramsar. However, as both boreholes are located close to the Lower River Arun, and the North Arundel Drought Order zone of influence does not include the European sites, it is considered unlikely that LSEs would occur.

4.3.1.5 South East Water Drought Plan

There are three designated sites within the zone of hydrological influence of drought management options within both South East Water's and Southern Water's Drought Plans: Ashdown Forest SAC and SPA, Peter's Pit SAC, and North Downs Woodland SAC.

The applicable options from South East Water's Drought Plan are:

- the River Ouse Drought Permit which influences Ashdown Forest SAC and SPA
- the Halling Drought Permit which influences Peter's Pit SAC and North Downs Woodland SAC

The applicable options from Southern Water's Drought Plan are Weir Wood Reservoir[16] and the River Medway Scheme Drought Orders/permits.

In both plans, North Downs Woodland SAC has been screened out as the qualifying features are not considered to be surface water or groundwater dependent (and no construction impacts were identified). No hydrological links to Ashdown Forest SAC and SPA were identified for either the Weir Wood Reservoir Drought Permit (Southern Water) or the River Ouse Drought Permit option (South East Water) and therefore no LSEs are anticipated.

The Weir Wood Reservoir and River Medway Scheme Drought Permit options affect surface water levels and flows in the River Medway rather than the groundwater sources supporting Peter's Pit SAC, and the groundwater assessment for the Halling Drought Permit concluded no adverse effects on the groundwater due to the groundwater flow direction. Therefore, no LSEs are anticipated on this SAC.

4.3.1.6 SES Water Drought Plan

SES Water's Drought Plan concluded that there were no European sites within the supply area, or near the boundaries of the supply area, that would be impacted by the drought plan options. However, the Bough Beech/River Eden Drought Permit could be implemented by SES Water at the same time as the Weir Wood Reservoir and the River Medway Scheme Drought Permit options.

[16] We are currently rebuilding the treatment works at Weir Wood.

The Bough Beech River Eden abstraction is restricted to the winter period from September to April. There are two potential Drought Permits that can be sought for Bought Beech River Eden abstraction:

- Option 1 – abstraction from the River Eden to continue for May only
- Option 2 – abstraction from the River Eden extends after May into early summer.

As the hydrological effects of the Weir Wood Reservoir summer Drought Permit are almost entirely negated by intervening catchment inflows at the confluence of the River Eden, no likely significant in-combination effects are anticipated.

Concurrent implementation of the Weir Wood Reservoir Drought Permit (summer) and the River Medway Scheme Drought Permit (summer) with SES Water's Bough Beech/River Eden Drought Order would only occur during the summer period (May onwards). Given the dominant effect of the River Medway Scheme Drought Permit on flows in the River Medway compared to the other two options, the in-combination hydrological impact is assessed as no greater than the moderate hydrological impact assessed for the River Medway Scheme implemented on its own. No likely significant in-combination effects are anticipated between any combinations of these three drought management measures in summer.

4.3.1.7 Thames Water Draft Drought Plan

No in-combination impacts between drought management options in Southern Water's draft Drought Plan and Thames Water's draft Drought Plan have been identified as the European sites being considered in both plans do not overlap. Consequently, no in-combination LSEs are anticipated.

4.3.1.8 Wessex Water Drought Plan

No in-combination impacts between drought management options in Southern Water's draft Drought Plan and Wessex Water's Drought Plan have been identified as the European sites being considered in both plans do not overlap. Consequently, no in-combination LSEs are anticipated.

Other Water Company Water Resource Management Plans (WRMPs) 2019

The information used to carry out these assessments is considered reflect the most up to date information as set out in other water company WRMP19s.

All of the neighbouring water companies to Southern Water have published 2019 WRMPs which have been examined along with outputs of a Water Resources South East Group (WRSE) environmental assessment project. The WRSE group includes six south east water companies (Affinity Water, Portsmouth Water, South East Water, Southern Water, SES Water and Thames Water). The purpose of the project was to input to the development of long-term best value plans for securing water supplies in the South East. Since 2016 the WRSE has been working to Improve the approach to undertaking cumulative effects assessment for WRMP options developed by neighbouring water companies in the South East of England.

The latest piece of work aimed to identify the potential for cumulative effects between the six WRSE water companies, to support their WRMP19 and related SEAs in a regional context. It provided a unique opportunity for communication between the six water companies and sharing of respective WRMP19 geographical information.

Information sharing facilitated through WRSE together with the information contained in the published WRMP19 strategies highlighted the following WRMP19 schemes that required in-combination assessment:

a) joint Southern Water / South East Water Medway water reuse scheme: the potential for in-combination cumulative effects of this scheme are the same as those already identified above under the Southern Water WRMP19 assessment

b) three groundwater options included in the Affinity Water WRMP19 would involve increased abstraction from the East Kent Chalk–- Stour WFD groundwater body together with the Southern Water Sandwich Drought Permit* option are considered unlikely to lead to any likely significant in-combination effects on the Stodmarsh SAC, the Stodmarsh SPA and Ramsar site, or the Thanet Coast and Sandwich Bay SPA and Ramsar.

* Note that we have removed the Sandwich and Faversham drought permits from our drought plan. We have done this because we have recently varied these abstraction licences so that there would no longer be a benefit from these drought permits.

For other water companies outside of the WRSE group, but neighbouring Southern Water (Bournemouth Water, Cholderton and District Water and Wessex Water), the review of published WRMP19 strategies have indicated no potential in-combination likely significant effects on any European sites with the revised draft Drought Plan.

Bournemouth Water's 2019 WRMP scheme to provide a bulk supply to Southern Water's Western operational area has already been discussed above and has no likely in-combination effects on any European sites.

As such, no likely significant effects on European sites are anticipated in relation to the WRMPs of these other three water companies.

Other Plans and Projects

4.3.1.9 Environment Agency National Drought Plan

The potential for in-combination effects of the Southern Water drought management options with the Environment Agency's National Drought Action Plan has been assessed. No in-combination impacts between the Environment Agency's National Drought Action Plan and Southern Water's drought options are anticipated. However, this should be considered further at the time of any potential implementation of drought management measures in liaison with the Environment Agency, particularly in respect of local Environment Agency actions in the Southern Water supply and water source catchment areas.

4.3.1.10 Thames River Basin District and South East River Basin District: River Basin Management Plans 2015

The River Basin Management Plans set out how organisations, stakeholders and communities can work together to improve the water environment. Parts of the Thames RBMP and South East RBMP overlap with Southern Water's operational and water source catchment boundaries. The RBMPs have identified potential hazards associated with the implementation of measures to address significant water management issues (SWMI). As the level of detail within the plans does not allow consideration of effects on each European site individually, the plans have been assessed by the Environment Agency as to the potential impacts on the qualifying features of sites as a collective i.e. 'dry grassland' across several SACs.

The HRAs of the RBMPs have concluded that none of the measures identified in the plans would have any significant adverse effects on any European site, as the locations where the measures would be implemented are not constrained. The measures would also be implemented in such a way that there would be no in-combination effects within the RBMPs.

Therefore, no in-combination impacts with Southern Water's Drought Plan have been identified, and no in-combination LSEs are anticipated.

4.3.1.11 Lower Tidal River Arun Flood Management Strategy[17]

The Environment Agency has prepared a long-term plan to manage the risk of flooding from the tidal River Arun between Pallingham and Littlehampton. The scheme was formally approved in March 2014 and consists of a range of measures and recommends maintaining and enhancing many existing flood defences and providing some new ones in strategic locations.

The Pulborough to Houghton Strategy Unit (SU3) covers the Arun Valley SAC, SPA and Ramsar sites. The Environment Agency have identified that the risk of flooding to the sites would change under every proposed management option. The Preferred Option for SU3 within the Flood Management Strategy is to "*Sustain until year 10, pending completion of technical studies to determine the best long-term option for the Arun Valley SPA/Ramsar/cSAC."* It also identifies that the key driver for this option is the need for compliance with the Habitats Regulations. During consultation of the Drought Plan 2019 with Natural England, it is understood that the flood banks will be in place until approximately 2025, after which there is a proposal to remove the flood banks. The end of the 10 year "*sustain*" period is approximately 2024 (i.e. within the Draft Drought Plan 2022 period), and as such any potential impacts would require consideration in combination. However, at the time of writing (February 2021), no further information was publicly available regarding the removal of the flood banks within SU3 and the potential effects this would have (beyond seasonal flooding during times of high flow, when the Drought Plan 2022 measures at Pulborough would not be required). As it is anticipated that the Pulborough Surface water Drought Permits / Order will be in place by 2022, the baseline for studies to inform the removal of the flood banks will include the Permits and order included within this Draft Drought Plan 2022. Further HRA will need to be undertaken in the in-combination assessment within the scheme HRA for the removal of the flood banks.

4.3.1.12 River Medway Flood Storage Areas Project

The Leigh Barrier is an existing flood storage area to reduce the risk of flooding to properties and 300 business in the town of Tonbridge, Kent (River Medway). In 2010, the revised Middle Medway Strategy set out options to manage flood risk from the River Medway, the River Beult, and the River Teise. These options include enlarging the capacity of the Leigh Flood Storage Area. The River Medway Flood Storage Areas project[18] concluded that increasing the capacity of the Leigh flood storage area should be progressed.

Construction is anticipated between 2019 and 2022. However, it is considered unlikely that construction or operation of the scheme would lead to in-combination LSEs on any European site with the Southern Water Drought Plan.

[17] Environment Agency (2012) Lower Tidal River Arun Draft flood risk management strategy Consultation on draft recommendations for managing the risk of flooding from the tidal River Arun. Accessed at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/322086/LTRAS_Consultation_Document_cf575d.pdf.

[18] https://www.gov.uk/government/publications/river-medway-flood-storage-areas-fsas-project/river-medway-flood-storage-areas-fsas-project

4.3.1.13 Shoreline Management Plans

Shoreline Management Plans provide a policy context for shoreline/coastal zone management and development. The following Shoreline Management Plans are available within the public domain and were considered for in-combination impacts:

- SMP 9 The Medway Estuary and Swale
- SMP10 Isle of Grain to South Foreland.
- SMP 11 Beachy Head to South Foreland
- SMP 12 Beachy Head to Selsey Bill (South Downs)
- SMP 13 Hurst Spit to Selsey Bill (North Solent)
- SMP 14 Isle of Wight
- SMP 15 Durlston Head to Hurst Spit (Poole & Christchurch Bays)

The assessments for any potential in-combination impacts between these plans and the measures contained Southern Water's Drought Plan (20220-2027) were considered with regards to spatial proximity and/or hydrological and/or hydrographical connectivity. No in-combination likely significant effects were identified in respect of the policies set out in the plans. Measures put forward in the Isle of Wight Shoreline Management Plan included the proposed creation of a 30.9Ha compensatory habitat of coastal grazing marsh for the Solent and Southampton Water Ramsar site. Such a measure could be considered to have a minor beneficial in-combination effect. The potential for in-combination effects would need to be reviewed again for an application-specific HRA against the latest version of the relevant Shoreline Management Plan if any options with the potential to affect the coastal zone were needed in a future drought event, in dialogue with the Environment Agency, local planning authority and/or other relevant statutory bodies and stakeholders.

5 Stage 1 screening conclusions and recommendations

No demand management measures have been assessed as having likely significant effects (LSE) on European sites. A summary of the conclusions of the HRA screening process for supply augmentation measures is presented in **Table 5.1 and** has been updated to reflect recent further Stage 1 LSE assessments. This shows that for several drought management options it was not possible to rule out LSEs on European sites, either alone or in-combination with other drought management options in Southern Water's Draft Drought Plan 2022.

Options where LSEs cannot be ruled out when implemented alone:

- Lower Itchen Sources Drought Order
- Candover Augmentation Scheme
- Caul Bourne Drought Permit
- Eastern Yar augmentation Drought Permit
- Darwell Drought Order

In addition, the 2023 HRAs concluded that the following sites require Stage 2 Appropriate Assessment

- Pulborough
- River Medway Scheme
- Test Surface Water (to reflect recent drought permit/order applications)

Options where the in-combination LSEs have not been ruled out at Stage 1 screening:

- Test, River Itchen and Isle of Wight options
- Eastern Yar and Caul Bourne
- Candover Augmentation Scheme and Lower Itchen sources Drought Orders

On the basis of the screening assessment findings, Appropriate Assessment has been carried out for the above drought management options as discussed in Part B of this HRA report, with the exception of the HRAs that are subject to ongoing discussions with our environment regulators (Pulborough, Test and River Medway – The conclusions of the Appropriate Assessment may be subject to change and this HRA will be updated accordingly at this time).

Table 5.1 Summary of HRA screening conclusions for supply augmentation measures

Drought Management Measure	Likely significant effect on European site(s) alone?	In-combination likely significant effects with other Southern Water drought management options?	In-combination likely significant effects with other WRMPs and Drought Plans?	Stage 2 Appropriate Assessment (AA) required?
Tankering of water	No	No	No	No
Additional import from Portsmouth Water	No	No	No	No
Rest groundwater sources – Isle of Wight	No	No	No	No
Rest groundwater sources – Sussex Worthing	No	No	No	No
Rest Weir Wood reservoir	No	No	No	No
Lukely Brook	No	No	No	No
Caul Bourne	Yes	Yes	No	Yes
Eastern Yar Augmentation Scheme	Yes	Yes	No	Yes
Test Valley	No	No	No	No
Test Surface Water Drought Permit and Drought Order	Yes	*No	No	**Yes
Candover Augmentation Scheme	Yes	Yes	No	Yes
Lower Itchen Sources	Yes	Yes	No	Yes
Pulborough (Surface water)	Yes	No	No	Yes
***Weir Wood	No	No	No	No
***East Worthing	No	No	No	No
***North Arundel	No	No	No	No
River Medway Scheme	Yes	No	No	Yes
Darwell	Yes	No	No	Yes

**No in-combination assessment necessary as River Test is first permit to be used before other are introduced. Any in-combination assessments are undertaken via the other sources.*

*** the LSE for Test Surface Water has been included as a reflection of recent drought permit and order applications.*

**** awaiting individual HRA updates to be completed*

We have removed the Sandwich and Faversham drought permits from this table. We have done this because we have recently varied these abstraction licences so that there would no longer be a benefit from these drought permits.

PART B – Stage 2 Appropriate Assessment

Part B of this HRA report sets out the Stage 2 Appropriate Assessments for those Drought Plan options for which the Stage 1 screening assessment was not able to conclude no likely significant effects on a European site or sites, either alone or in-combination with other options.

6 Stage 2: Appropriate Assessment

6.1 Introduction and approach

Legislation and guidance

The responsibility for undertaking the Appropriate Assessments lies with Southern Water as the plan-making authority, as described earlier in this HRA report. The Appropriate Assessments have been carried out in accordance with the Habitats Directive and the Conservation of Habitats and Species Regulations 2017 (Amended) (the Habitats Regulations) and taking account of available national guidance from Natural England and the Habitats Regulations Assessment Handbook[19].

Conservation objectives

The Habitats Regulations require that the Appropriate Assessment considers "*the implications for the site in view of that site's conservation objectives*". In accordance with the Habitats Directive, the objectives aim to achieve the favourable conservation status of the habitat and species features for which the European site is designated (see **Box 6.1**).

Assessment

The Appropriate Assessment considers the potentially damaging aspects of the proposed drought plan measures and the potential effects on the qualifying features of the relevant European sites and likely achievement of the conservation objectives of the site. The assessment characterises the impacts in terms of their likelihood, nature, scale, severity and duration.

The potential for adverse effect on the integrity of the site depends on the scale and magnitude of the effects of the drought plan measure and the predicted impacts, taking into account the distribution of the qualifying features across the relevant European sites in relation to the predicted impact and the location, timing and duration of the proposed Drought Order and the level of understanding of the effect, such as whether it has been recorded before and, based on current ecological knowledge, whether it can be expected to operate at the site in question.

Where qualitative and/or quantitative information is available, this has been used to inform the assessment. Where this information is not available, professional judgement has been used. In some cases, the ecological functioning of the site and the likely effects are well understood and documented elsewhere, for instance in studies previously commissioned to inform the Environment Agency's Habitats Directive Review of Consents. Where there is not sufficient information to undertake the assessment, this has been identified.

[19] Tyldesley, D. and Chapman C. (2021) - The Habitats Regulations Assessment Handbook. DTA Publications.

Box 6.1 Favourable conservation status definition

Favourable conservation status as defined in Articles 1(e) and 1(i) of the Habitats Directive

"*The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when:*

- *Its natural range and areas it covers within that range are stable or increasing, and*
- *The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and*
- *The conservation status of its typical species is favourable.*

The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

- *Population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
- *The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis*."

The Appropriate Assessment set outs, in sufficient detail for it to be transparent and understandable, what the effects of the proposed drought plan measure (either alone or in-combination with other measures, activities, plans or programmes) are likely to be on each qualifying feature of the relevant European site, referring to relevant background documents and other information on which these judgements, which are essentially ecological judgements, rely.

Guidance[20] states that the size or complexity of the assessment will not necessarily reflect the scale of the proposal, but rather the complexity of the potential effects. The length of the Appropriate Assessment may not reflect the complexity of ecological judgements made to arrive at the necessary conclusions. Very complex ecological analysis and judgements may be expressed succinctly, with detailed supporting analyses contained in appendices or clearly referenced separate documents (for example, the accompanying Environmental Assessment Reports prepared for each of the Drought Permits/Orders subject to Appropriate Assessment).

Mitigation measures

The Appropriate Assessment includes consideration of any potential mitigation measures that, in addition to any which may already form part of the drought plan measure specification (often

[20]Tyldesley, D. and Hoskin, R. (2008) *Assessing projects under the Habitats Directive: guidance for competent authorities*. Report to the Countryside Council for Wales, Bangor.

referred to as embedded mitigation), to determine whether any can reduce the likelihood, magnitude, scale, and duration of the effect to a lower level. The Appropriate Assessment seeks to identify mitigation measures that are capable of implementation and will reduce the impact to the lowest level possible. These measures can include both avoidance and reduction measures, with the former being the preferred option.

The Appropriate Assessment has assumed that measures to minimise impacts upon qualifying features and conservation objectives of the designated sites will be embedded within the final specification of any Drought Plan measure (and likely to be formally included as part of the Statutory Instrument when granted) and therefore no supplementary mitigation measures will be required.

Integrity test

The integrity test is the conclusion of the Appropriate Assessment and requires the competent authority to ascertain whether the proposed drought plan measure (either alone or in-combination), will not have an adverse effect on site integrity. The following definition of site integrity has previously been provided by Defra:

> "*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified*"[21].

From the evidence and assessments undertaken, a statement has been made as to whether it can be ascertained that the proposed Drought Order alone, or in-combination with other Drought Orders, other activities, plans or projects, will not adversely affect the integrity of the relevant European sites.

Monitoring

Details of any recommended monitoring are described in the Appropriate Assessments. Monitoring is recommended either for the purposes of validating the findings of the Appropriate Assessment, and/or to provide 'early warning' monitoring which would enable any actions to be stopped, paused, reduced in scale or altered should an unexpected adverse impact be recorded when the proposed drought plan measure is being implemented.

Limitations and residual uncertainties

Information provided by third parties, including publicly available information and databases, is considered correct at the time of publication. Due to the dynamic nature of the environment, conditions may change in the period between the preparation of this HRA report, and the implementation of the proposed drought plan measure. This HRA Report is a strategic, plan-level assessment to support the Drought Plan and is not an application-specific ("project" level) assessment.

The Appropriate Assessment has been undertaken in as detailed a way as possible consistent with the strategic nature of the Drought Pan and using all available data sources where they exist. However, the conclusions drawn from this are necessarily limited by the age, type, coverage and availability of data.

Any uncertainties and the limitations of the assessment process are acknowledged and highlighted in the Appropriate Assessments provided below.

[21]Defra Circular 01/2005.

As part of the ongoing Drought Plan consultation process, further discussion has been undertaken on the revised Drought Plan Appropriate Assessments and supporting EARs and comments received by Natural England and the Environment Agency have been addressed in the final Drought Plan Appropriate Assessments.

6.2 Lower Itchen sources Drought Order

In order to protect public water supplies within Southern Water's Hampshire Southampton East Water Resources Zone in the event of a future severe drought, Southern Water may need to apply to the Secretary of State for a Drought Order to allow continued abstraction from the Lower Itchen sources. **Table 6.1** summarises the key components of the Lower Itchen sources Drought Order - further details are set out in the Drought Plan and accompanying Lower Itchen sources Environmental Assessment Report.

A summary of the qualifying features screened in for the Appropriate Assessment is provided in **Table 6.1,** i.e. those qualifying features[22] sensitive to the effects of the Drought Order where the HRA screening assessment was unable to confirm there would be no likely significant effects on the SAC.

Table 6.1 Summary of proposed Lower Itchen sources Drought Order and the qualifying features of the SAC screened in for Appropriate Assessment

Lower Itchen Sources Drought Order	
Drought order details	The Drought Order would authorise a reduction of the Hands-Off Flow (HOF) conditions as follows: a) From 198 Ml/d to 160 Ml/d near Eastleigh (Southern Water sources) b) From 194 Ml/d to 150 Ml/d adjacent Medway Estuary Park (Portsmouth Water source)
European sites screened in for Appropriate Assessment	River Itchen SAC
Qualifying features screened in for Appropriate Assessment	**River Itchen SAC** **Annex I habitats that are a primary reason for selection:** 3260 water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Sub-Type 1 chalk stream habitat) **Annex II species that are a primary reason for selection of this site:** 1044 Southern damselfly *Coenagrion mercurial* **Annex II species present as a qualifying feature, but not a primary reason for site selection:** 1106 Atlantic salmon *Salmo salar*

River Itchen SAC

[22] For a SAC, the citations refer to qualifying features that are '*a primary reason for selection*' and those which are '*present as a qualifying feature, but not a primary reason for selection*'. For assessment purposes, this distinction is irrelevant: all are 'qualifying features' and should be treated equally (Tyldesley, D. and Chapman C. (2015) - The Habitats Regulations Assessment Handbook. Version 4 (DTA Publications)).

In accordance with the Habitats Regulations, this Appropriate Assessment provides details and assesses the potential effects on those qualifying features of the River Itchen SAC that have been screened in for assessment (water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Southern damselfly and Atlantic salmon).

Conservation objectives have been set for the River Itchen SAC as set out below:

> "*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*".

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.

There are several variants of this habitat in the UK, depending on geology and river type. In each, *Ranunculus* species are associated with a different assemblage of other aquatic plants, such as water-cress *Rorippa nasturtium-aquaticum*, water-starworts *Callitriche* spp., water-parsnips *Sium latifolium* and *Berula erecta*, water-milfoils *Myriophyllum* spp. and water forget-me-not *Myosotis scorpioides*. In some rivers, the cover of these species may exceed that of *Ranunculus* species. Three main habitat sub-types are defined by substrate and the dominant species within the *Ranunculus* community.

The River Itchen is a classic example of a sub-type 1 chalk river. The river is dominated throughout by aquatic *Ranunculus* spp. The headwaters contain pond water-crowfoot *Ranunculus peltatus*, while two *Ranunculus* species occur further downstream: stream water-crowfoot *R. penicillatus* ssp. *pseudofluitans*, a species especially characteristic of calcium-rich rivers, and river water-crowfoot *R. fluitans.*

Annex II - *Coenagrion mercuriale*; Southern damselfly

Strong populations of Southern damselfly occur in the River Itchen SAC. The site represents one of the major population centres in the UK with a population estimated to be in the hundreds of individuals. It also represents a population in a managed chalk-river flood plain, an unusual habitat for this species in the UK, rather than being supported by heathland habitat.

Annex II – *Salmo salar*; Atlantic salmon

The UK Atlantic salmon population is important in a European context, and this has influenced the selection of SACs. Atlantic salmon are an Annex II species in the Habitats Directive which are present in the River Itchen SAC as a qualifying feature, but not a primary reason for site selection.

River Itchen salmon have a relatively short life-cycle compared to non-chalk stream populations with many juvenile salmon remaining in the river for only one year and most returning adults spending only one year at sea. The reason for the short period of growth in freshwater is due to the high growth rates that these fish can achieve in the rich chalk stream habitat.

Adult salmon enter the River Itchen to spawn. Spawning takes place in the winter (mainly December and January), but the fish enter the river many months before this, typically between May and August. Fish enter the non-tidal river at Wood Mill Pool whereupon some fish move rapidly up the river towards the spawning areas while most hold up in the lower river. Catches in the river suggest that peak movements upriver occur between June and September (Salmonid and Freshwater Fisheries Statistics for England and Wales, 2010-16).

Favourable Condition Flow Targets for the River Itchen SAC

Flow targets for the River Itchen SAC, derived primarily from an evaluation of macroinvertebrate communities[23], were developed as part of the Review of Consents process. These flow targets, which underpin the River Itchen Sustainability Reductions that informed the new proposed abstraction licence conditions, are summarised in **Table 6.2**. The two Management Units relevant to this assessment are Management Unit 5 (Easton gauging station to Allbrook and Highbridge gauging station) and Management Unit 6 (Allbrook and Highbridge gauging station to Riverside Park gauging station).

Table 6.2 River Itchen invertebrate flow targets

Stage 4 Invertebrate flow criteria (Ml/d)	Management unit					
	1	2	3	4	5	6
1. Long-term summer Q95 flow must exceed:	26	92	25	241	**262**	**257**
2. Flow should not fall below:	20	69	19	182	**198**	**194**
3. Summer Q95 should not fall below:	24 in more than 1:5 years	83 in more than 1:5 years	23 in more than 1:6 years	218 in more than 1:6 years	**237 in more than 1:6 years**	**233 in more than 1:5 years**

Notes: the two management units relevant to the assessment are highlighted in bold.

Favourable Condition Water Quality Targets for the River Itchen SAC

Natural England and the Environment Agency have set out the standards that need to be achieved for elements of environmental quality that support the achievement of conservation objectives for the River Itchen SAC (and favourable condition targets for the River Itchen SSSI) as regards Common Standards Monitoring Guidance (CSMG) targets for water quality. Whilst water quality is generally of a high standard, the drought order may lead to a temporary deterioration in water quality, including when considered against the CSMG targets.

River Itchen at Itchen Surface Water

The CSMG assessment for the River Itchen at Itchen Surface Water (**Table 6.3**) has been carried out with data from the Candover Stream at Borough Bridge water quality monitoring

[23] Exley, K (2005). River Itchen macroinvertebrate community relationship to river flow changes. Environment Agency Report.

site for the period 2005 to 2020 (consistent with the WFD assessments above) and using the specific proposed CSMG for the Candover Stream jointly agreed between Natural England and the Environment Agency.

Table 6.3 Compliance against proposed water quality CSMG targets for the River Itchen at Itchen Surface Water

CSMG Parameter	CSMG Standards for Itchen WFD water body (GB107042022580)	Otterbourne memorial gardens Water Quality (2018-2020)	Compliant?
Total ammonia (90th percentile)	0.25 mg/L	0.03mg/L	Compliant
un-ionised ammonia (95th percentile)	0.021 mg/L	0.001mg/L	Compliant
BOD (mean)	1.5 mg/L	1.24mg/L	Compliant
SRP [24](annual mean)	0.03 mg/L target	0.04mg/L	Non-compliant
SRP (March - September mean)	0.03 mg/L target	0.035mg/L	Non-compliant
Dissolved Oxygen (10th percentile)	85%	97%	Compliant

The assessment concluded that, over the record period 2018-2020, compliance with the CSMG targets is achieved for all parameters except for SRP. It is noted that since August 2020 parameters have been monitored by Southern Water at four sites along the River Itchen (St Cross Bridge, Otterbourne, Bishopstoke and Gaters Mill) as part of the River Itchen Drought Order Monitoring Package. Once a longer more substantial record is available, this assessment will be updated.

The Drought Order has the potential to lead an increase to SRP from the baseline conditions and there is a medium risk that SRP may not meet the CSMG target during Drought Order implementation downstream of Itchen Surface Water.

There is a medium risk that lower river flows in the Candover Stream due to the Drought Order will lead to some temporary local reductions to dissolved oxygen levels in the impacted reach (and a possible increase to BOD) that may temporarily fall below the CSMG target, principally during summer (including due to any die-back of macrophytes due to drought conditions).

River Itchen at Gaters Mill

The CSMG assessment for the River Itchen at Gaters Mill (**Table 6.4**) has been carried out with data for the period 2018 to 2020 (consistent with the WFD assessments above) and using the specific CSMG targets agreed for Itchen WFD water body between Natural England and the Environment Agency.

[24] SRP stands for soluble reactive phosphorus

Table 6.4 Compliance against agreed water quality CSMG standards for the River Itchen at Gaters Mill

CSMG Parameter	CSMG Standards for Itchen WFD water body (GB107042022580)	Gaters Mill Water Quality (2018-2020)	Compliant?
Total ammonia (90th percentile)	0.25 mg/L	0.069mg/L	Compliant
un-ionised ammonia (95th percentile)	0.021 mg/L	0.002mg/L	Compliant
BOD (mean)	1.5 mg/L	1.18mg/L	Compliant
SRP (annual mean)	0.03 mg/L target	0.075mg/L	Non-compliant
SRP (March - September mean)	0.03 mg/L target	0.058mg/L	Non-compliant
Dissolved Oxygen (10th percentile)	85%	87%	Compliant

The assessment concluded that, over the record period 2018-2020, compliance with the CSMG targets is achieved for ammonia, dissolved oxygen and BOD. Non-compliance is noted with regards to SRP concentrations.

It is noted that since August 2020 parameters have been monitored by Southern Water at four sites along the River Itchen (St Cross Bridge, Otterbourne, Bishopstoke and Gaters Mill) as part of the River Itchen Drought Order Monitoring Package. Once a longer more substantial record is available, this assessment will be updated.

The Drought Order has the potential to lead an increase to SRP from the baseline conditions and there is a medium risk that SRP may not meet the relevant SRP CSMG target during drought order implementation downstream of Gaters Mill, including due to the reduced dilution for the discharges from Chickenhall wastewater treatment works upstream.

There is a medium risk that lower river flows in the Candover Stream due to the Drought Order will lead to some temporary deterioration to dissolved oxygen levels in the impacted reach downstream of Gaters Mill (and a possible increase to BOD), principally during summer (including due to any die-back of macrophytes due to drought conditions and less dilution for the discharges from Chickenhall wastewater treatment works upstream).

Favourable Condition Tables for the River Itchen SAC

Definitions of Favourable Condition (DFCs) contained within Favourable Condition Tables (FCTs) are used to periodically measure and assess the condition of both notified SSSI features and designated European Site features. The definitions comprise one or more condition definitions for the special interest features at the specific site. These are subject to periodic review and may be updated to reflect new information or knowledge. DFCs are used by Natural England to determine if a site is in a favourable condition. The standards for favourable condition have been developed and are applied throughout the UK. Where SSSIs also form part of a European Site (such as a SAC or SPA), a separate document containing specific containing the Conservation Objectives is prepared (see below). The concepts of 'site integrity' and 'favourable condition' are similar and the assessment of a feature's condition will measure attributes that also represent aspects of a site's ecological integrity. This is because the DFCs do not represent a comprehensive or definitive list of all of the elements that might

contribute to site integrity, merely those that are most appropriate to monitor in order to rapidly determine the present condition of a feature.

The FCTs include site specific habitat condition objectives and species objectives that should be considered as part of the Appropriate Assessment, as discussed further below.

Potential impacts on the physical environment due to the Lower Itchen sources Drought Order

Implementation of the Drought Order, and the precise proportion of groundwater sources and surface water sources that would be used to abstract the additional volume of water, will be dependent on the hydrological and hydrogeological conditions prevailing at the time. Assessment of the hydrological and hydrogeological effects of implementing the Drought Order under different drought conditions has been carried and reported in detail in the Environmental Assessment Report that should be consulted in parallel to this report.

The hydrological modelling highlighted that the Drought Order has the potential to generate both surface water and groundwater impacts arising from abstraction at the Southern Water groundwater and surface water sources. The Drought Order will result in a flow reduction near Eastleigh which could be translated downstream to the tidal limit. It is assumed that Southern Water's Chickenhall WwTW at Eastleigh and the Portsmouth Water source on the Lower Itchen will discharge 20 Ml/d under low flow conditions and that other minor tributary inflows will be unchanged.

Groundwater abstraction under the Drought Order will result in additional groundwater drawdown. The impact on the Chalk aquifer has the potential consequence of reducing groundwater-surface water interactions over the extent where the Chalk is unconfined, i.e. north of Allbrook & Highbridge gauging station, with a resulting impact on surface water flows in this reach.

The nature of the Drought Order impact will be dependent on the operational split of the groundwater and surface water sources; increasing the component of groundwater abstraction will increase the groundwater impact. However, the overall impact on surface water flow may decrease as more water is obtained at the expense of aquifer storage.

Abstraction under the Drought Order at the Portsmouth Water source has the potential to impact surface water flows in the final reach of the River Itchen between the source and the tidal limit at Woodmill (and the downstream end of the River Itchen SAC). Over this final river reach to the tidal limit, the river traverses over low permeability Tertiary deposits. It is therefore hydraulically unconnected from the underlying Chalk aquifer, which is over 100 m below the surface. Therefore, no groundwater impacts are anticipated due to the changes arising from the abstraction at the Portsmouth Water source.

Downstream of Woodmill the river is tidal, and the small changes in flow due to the Drought Order are negligible in comparison to the influence of tidal system. Hydrological effects on the River Itchen estuary are therefore assessed as negligible and unlikely to have any direct ecological effects on migratory salmon passing through the estuary.

Potential effects on qualifying features scoped into the Appropriate Assessment

Detailed assessment of the potential effects of the Lower Itchen sources Drought Order on the qualifying features scoped in for assessment is provided in the Lower Itchen sources Drought Order Environmental Assessment Report which should be read in conjunction with this report.

The HRA screening assessment concluded that the water-sensitive habitats/species that could be adversely affected by abstraction were the macrophyte habitat, populations of Southern damselfly and Atlantic salmon. Assessment of the potential effect of the Drought Order on these features is presented below.

Annex I habitat - water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

The macrophyte community is a key component of the Annex I habitat - water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, which is the primary reason for designation. The River Itchen is a classic example of a sub-type 1 chalk river.

Macrophytes are key components of chalk ecosystems, significantly influencing the physical stream environment and the structure and functioning of stream ecology; providing food, habitats, refugia for riverine fauna and influencing biochemical cycles, hydrological properties and sediment dynamics at the local scale. As a result of the specific physicochemical conditions in chalk streams, chalk macrophyte communities frequently present a typical assemblage, containing *Ranunculus penicillatus ssp. pseudofluitans*, *Callitriche obtusangula, Callitriche stagnalis*, *Callitriche platycarpa, Berula erecta, Oenanthe fluviatilis* and *Rorippa nasturtium-aquaticum*, as dominant taxa.

Ranunculus penicillatus ssp. Pseudofluitans is of particular importance as the keystone chalk stream macrophyte. It is of particular interest due to its dominance within the community where it improves flow and habitat heterogeneity and provides refugia and support for macroinvertebrates and other riverine fauna; it is a sensitive indicator of prevailing environmental conditions.

Baseline

Understanding the baseline macrophyte community in the affected river reaches helps assist with the assessment of the potential impacts of the Drought Order. Due to the braided nature of the river channel, none of the macrophyte monitoring sites on the Itchen provide an assessment of the macrophyte community at a point that is representative of the whole flow in the river but, cumulatively, the Itchen macrophyte monitoring data provide a baseline of species composition throughout the river.

Macrophyte species lists for the monitoring site downstream of Norris Bridge and upstream of the Southern Water Lower Itchen surface water source, demonstrate a typical chalk river with dominant instream taxa of *Ranunculus sp, Callitriche spp. and Berula erecta.* High levels of *Cladophora sp.* and *Vaucheria sp.* suggest nutrient enrichment may be a problem in this section of river.

The macrophyte species lists for all sections downstream of the Southern Water Lower Itchen surface water source indicate a similarly typical chalk stream assemblage with dominant instream taxa of *Ranunculus sp, Callitriche spp.* and *Berula erecta, Berula erecta* cover decreases significantly in the downstream direction and is almost absent from the section of river near to Chickenhall and only present with much lower cover downstream of this point, reflecting the downstream increasing gradient of discharge. Whilst it is evident that the community structure varies spatially throughout the river, the core taxa present remain consistent between the monitoring sites and the typical chalk stream assemblage is maintained throughout.

A fast species turnover was observed in all reaches with high diversity over the long-term but small number of taxa at any one survey.

The Itchen upstream of the Gaters Mill area supports a typical chalk stream community dominated by *Ranunculus sp. Calitriche sp* and *Oenanthe fluviatilis*. Compared to sites further upstream, however, *Berula erecta* cover has declined and *Cladophora sp*. has increased.

No macrophyte data are available for the final reach downstream of the Portsmouth Water Lower Itchen source which may be due to the highly modified and canalised reach around the Riverside Park, and which is therefore likely to only support a much restricted macrophyte community due to morphological as well as hydraulic constraints. Immediately downstream of Riverside Park is the natural tidal limit; it is therefore likely that the typically chalk stream community will begin a transition downstream of Riverside Park in favour of a more tidally influenced, transitional water macrophyte community.

Assessment

A number of standard macrophyte community metrics were provided by the Environment Agency:

- **MTR** – Mean Trophic Rank describes the trophic status of a site. The MTR increases with decreasing eutrophy, with a theoretical maximum of 100 and a minimum of 10.
- **MFR** - Macrophyte Flow Rank calculates the dominant flow character of the community reflected by the assemblages present in the survey reach (after Holmes, 1999). Each species is assigned a flow rank based on their preference for low or high flow these are combined with abundance and cover measures to provide an overall MFR.
- **RMHI** describes community preference for flow conditions on a scale of 1 to 10. A score of 10 would indicate a plant community that prefers very slow flow or no-flow conditions, while scores of 1 are found in plant communities with a preference for very fast flows;
- **RMNI** is designed to categorise macrophyte community preference to nutrient levels. Scores range from 1 to 10 with scores of 1 representing plant communities with preference for very low levels of nutrients and 10 representing communities with a preference for very enriched conditions;
- **NaTAXA** is a community richness index and simply describes the number of truly aquatic taxa present. Higher values represent a more diverse and rich aquatic plant community;
- **NFG** is another richness/diversity index and describes the number of functional macrophyte groups existing within a surveyed plant community. Twenty-four different functional groups (FG) have been defined. The higher the NFG value, the more diverse and richer the plant community is considered to be.

Only taxa that are obligate hydrophytes (i.e. truly aquatic) are assigned scores under the NaTAXA and NFG scoring systems.

The summary community indices reveal very little difference between the sites upstream and downstream of the Southern Water Lower Itchen sources. The RMNI and RMHI provide community level scores which account for variation in the number of taxa recorded, providing a robust classification of the overall flow and nutrient preference of the community. The range apparent within RMNI and RMHI is small and provides confidence that the mean values presented are meaningful in terms of summarising macrophyte community characteristics at each site.

The high mean RMNI values suggest that both upstream and downstream of the Southern Water sources, the macrophyte communities are adapted to mesotrophic (moderate) to eutrophic (high) nutrient conditions. Similarly, the high mean RMHI values suggest that both reaches support communities that are adapted to low to moderate flow velocities.

The indices upstream of the Portsmouth Water source show similar ranges to those further upstream but with a lower MTR and similar adaptation to high nutrient and low flow velocities. A greater disparity in the NFG and NaTaxa at the most downstream site near Gaters Mill could suggest a richer and more diverse community.

Flow variable impacts on macrophyte assemblages

Plant distribution is influenced by many physical and chemical factors including flow; nutrient availability, light availability, shading and turbidity, substrate, and temperature; along with the effects of biological interactions, such as competition, grazing and seasonal management. Flow conditions are considered a key determining factor affecting macrophyte distribution, particularly within the *Ranunculion fluitantis* and *Callitricho-Batrachion* communities in chalk stream[25]. Typically, as flows increase, chalk submerged macrophyte dominance shifts between *Ranunculus spp*., *Berula erecta*, and *Callitriche spp.* depending on flow conditions and other in-stream factors[26].

Investigations progressed under the Environment Agency's Habitats Regulations Review of Consents Stage 3 Appropriate Assessment[27] and the Stage 4 Site Action Plan[28] noted that macrophyte communities on the River Itchen are strongly influenced by non-flow related factors, some of which are controlled by land and river bank management practices. Cranston and Darby[29] completed a review of the literature that assesses the many influences affecting the growth and distribution of *Ranunculus* spp in chalk rivers and concluded that water velocity was shown to be of prime importance due to the high photosynthetic rate of *Ranunculus spp*: fast flows are required to deliver oxygen and carbon to the plant. Velocity also acts indirectly to remove potentially competitive or shading algae and clearing silt from gravels. Key drivers or influences upon velocity comprise natural climate cycles, abstraction, channel over-widening and impoundment.

Velocity is a prime factor for *Ranunculus* spp. all year around; critical thresholds of optimal velocities and discharges will vary seasonally according to the life cycle of the plant. In summer, sufficient flow is necessary to provide good conditions for growth whilst over winter peak flows are important to clear the senescent vegetation and silt. The timing of the autumn/winter increase in discharge is important, leading to higher or lower *Ranunculus* spp survival the next year[30]. Once established, the plant itself exerts an influence on the hydrological environment around it, changing the velocity passing through, over and under the plant and providing very specific micro-niches exploited by its associated macrophyte and macroinvertebrate community. They also provide refuges and a feeding resource to fish

[25] Poynter, A.J.W. (2013) Impacts of environmental stressors on the River Itchen *Ranunculus* community. A thesis submitted to the University of Birmingham for the degree of Doctor of Philosophy. Available at http://etheses.bham.ac.uk/5112/1/Poynter14PhD.pdf

[26] Wright, J. F., Clarke, R. T., Gunn, R. J. M., Kneebone, N. T. & Davy-Bowker, J. (2004). Impact of major changes in flow regime on the macroinvertebrate assemblages of four chalk stream sites, 1997-2001. River Research and Applications 20, 775-794.

[27] Environment Agency (2005) River Itchen SAC. Habitats Regulations Review of Consents Stage 3 Appropriate Assessment. Environment Agency

[28] Environment Agency (2007) River Itchen SAC Stage 4 Site Action Plan.

[29] Cranston E. and Darby E. (2004) Ranunculus in Chalk Rivers: Phase 2. Environment Agency Science Report W1-042/TR

[30] Dawson, FH. Castellano, E. Ladle, M. (1978 The seasonal effects of aquatic plant growth on the flow of water in a stream. —Proc. Eur. Weed Res. Soc. 5th Int. Symp. Aquatic Weeds, Wageningen, p. 71 to 78.

communities. **Table 6.5** sets out the velocity bands for optimum *Ranunculus spp* growth in the summer season reported in studies undertaken on chalk rivers([29,31,32,33]).

Table 6.5 Velocity bands for optimum *Ranunculus spp* growth in the summer season

Growth Band	Velocity	Notes
Below optimum growth	<0.1 m/s	
Acceptable growth	0.1 to 0.3 m/s	The presence of other environmental conditions may affect growth (such as shading, competition from other plants etc.)
Optimal growth	0.3-0.5 m/s	
Below optimal growth	>0.5 m/s	Exceeding the summer upper boundary may cause mechanical stress

It should be noted that while these velocity values relate to summer/low flow conditions, the lifecycle of *Ranunculus spp* has adapted to the normal seasonal pattern of the hydrological cycle. Thus, it is worth noting that for any particular year, even if summer velocities are optimal, growth may be sub-optimal if the antecedent velocities, i.e. the previous winter, were insufficient. Strong autumn flows are needed to clear the senescent seasons' growth, to flush out any sediment that has built up around the plants and to prepare the gravels for the new cycle of growth.

While it is recognised that high antecedent winter velocities are required for healthy *Ranunculus spp* growth in the following summer, there is no guidance available that quantifies the range of suitable velocities. It should be noted that in drought conditions, dependent on the specific seasonality of the low flows, high antecedent winter velocities may well be absent - with or without the abstractions.

Research on *Ranunculus spp.* growth related to flow on the Itchen[34] confirmed the velocity bands presented above but also showed that, while growth was very limited in zero flows and even dewatered conditions, over a month-long period the plants did not senesce but adopted a semi-amphibious form that was stumpy with short, stunted, untidy leaves. This highlights a potential drought coping mechanism that, at least in the short term, may provide the plant with a strategy for dealing with low flow situations[35].

The phenology of *Ranunculus* spp. is most strongly influenced by seasonality, with extension and growth occurring during the spring, maturation in the summer, senescence in late autumn and dormancy in the winter. This annual growth pattern likely allows *R. pseudofluitans* to adapt to varying conditions by allowing vegetative dispersal (under favourable conditions sexual reproduction predominate)[35]. This growth pattern allows for rapid changes in dominance

[31] Atkins (2005) River Kennet SSSI Low Flows Investigation Final Report. For Thames Water
[32] Southey, J., (2004) River Kennet Macrophyte Flow Study Final Report. November 2004. Scott Wilson Kirkpatrick. Report to Thames Water Utilities plc.
[33] Poynter, A.J.W. (2013) Impacts of environmental stressors on the River Itchen Ranunculus community. A thesis submitted to the University of Birmingham for the degree of Doctor of Philosophy. Available at http://etheses.bham.ac.uk/5112/1/Poynter14PhD.pdf
[34] Poynter, A.J.W. (2013) Impacts of environmental stressors on the River Itchen Ranunculus community. A thesis submitted to the University of Birmingham for the degree of Doctor of Philosophy. Available at http://etheses.bham.ac.uk/5112/1/Poynter14PhD.pdf
[35] Poynter, A.J.W. (2013) Impacts of environmental stressors on the River Itchen Ranunculus community. A thesis submitted to the University of Birmingham for the degree of Doctor of Philosophy. Available at http://etheses.bham.ac.uk/5112/1/Poynter14PhD.pdf

between the key macrophyte species within the community to respond to changing environmental conditions, including flow. These changes can adjust rapidly to changing conditions such as extreme drought and will be reversed once the conditions revert to the status quo.

Velocities and depths in the Itchen SAC

Table **6.6** presents indicative calculations of velocities experienced in the river at different sample cross-sections with river flows at both the abstraction licence HOFs and the reduced Drought Order HOF conditions. These provide an indication of the sensitivity of velocities and depths to changes in low flow, and specifically the reduction in flow due to the Drought Order. Full details of the method used to derive these estimations and their limitations are presented in the Environmental Assessment Report. However, the results are uncertain and further work is required to improve the input data to the model to reduce these uncertainties.

The key points from **Table 6.6** are that:

- Velocities at all but three of the cross-sections are estimated to be above 0.3 m/s, both for the abstraction licence HOFs and the proposed Drought Order HOFs. At the three cross-sections where velocities are estimated to be below 0.3 m/s, the change in velocity between the abstraction licence HOF and the proposed Drought Order HOFs is very small (approximately 0.01 to 0.02 m/s).
- Water depths at all but one cross-section are estimated to be above 0.4 m, both for the abstraction licence HOFs and the proposed Drought Order HOFs. At the section where the depth is estimated to be below 0.4 m, the change in depth between the existing HOF and the proposed HOFs is very small (approximately 0.04 m).

The significance of the changes in velocity become apparent when compared against the velocity bands for optimum *Ranunculus sp* growth presented in Table 6.3. There are no cross-sections where the velocities drop below the acceptable range for *Ranunculus sp* growth. The vast majority of sites demonstrate optimum or borderline higher than optimum velocities, even with the Drought Order in place. Of the three locations with acceptable flow velocities, the impact of the Drought Order is to drop the velocity by around 0.02 m/s.

The range of depths experienced in the river remain suitable for *Ranunculus sp*. growth throughout the range of flows that are considered at the abstraction licence HOFs and the Drought Order HOFs. The impact of the Drought Order on the shallowest waters is to reduce the depth by approximately 4 cm – this change in depth is likely to be insignificant to *Ranunculus sp.* communities which will modify the water depths by their growth patterns in any case.

Table 6.6 Indicative calculations for the relationship between low flows, depths and velocities for sample cross-sections (noting the modelling uncertainties, these are values indicative only and there remains uncertainty as to the magnitude of effect in severe drought conditions)

ISIS cross section node and reach description	Inflow / HOF (Ml/d)	Flow at Section (Ml/d)	Velocity (m/s)	Velocity change (m/s)	Depth (m)	Depth change (m)
28.008 Otterbourne to Highbridge	198	149	0.41	-0.02	0.64	-0.04
	160	120	0.39		0.60	

ISIS cross section node and reach description	Inflow / HOF (Ml/d)	Flow at Section (Ml/d)	Velocity (m/s)	Velocity change (m/s)	Depth (m)	Depth change (m)
28.022 Otterbourne to Highbridge	198	149	0.24	-0.02	0.98	-0.09
	160	120	0.22		0.89	
28.034 Otterbourne to Highbridge	198	149	0.35	-0.02	0.47	-0.04
	160	120	0.33		0.43	
28.040 Otterbourne to Highbridge	198	149	0.37	-0.03	0.40	-0.03
	160	120	0.34		0.37	
28.058 Highbridge to Chickenhall	198	149	0.20	-0.01	0.85	-0.07
	160	120	0.19		0.78	
02.226 Highbridge to Chickenhall	198	198	0.22	-0.01	0.97	-0.07
	160	165	0.21		0.90	
02.247 Highbridge to Chickenhall	198	149	0.51	-0.03	0.83	-0.07
	160	120	0.48		0.76	
02.261 Chickenhall to Gaters Mill	198	218	0.42	-0.02	0.60	-0.05
	160	180	0.40		0.55	
01.046 Chickenhall to Gaters Mill	198	218	0.55	-0.03	0.77	-0.06
	160	180	0.52		0.71	
01.031 Chickenhall to Gaters Mill	198	218	0.51	-0.02	0.92	-0.06
	160	180	0.49		0.86	
01.020 Gaters Mill to Riverside Park	194		0.47	-0.03	0.69	-0.05
	150		0.44		0.64	
01.009 Gaters Mill to Riverside Park	194		0.54	-0.03	0.91	-0.06
	150		0.51		0.85	
01.003 Riverside Park to Woodmill	194		0.55	-0.04	0.69	-0.07
	150		0.51		0.62	

Assessment summary and conclusions

- The Itchen from Norris Bridge upstream of Otterbourne to upstream of Gaters Mill supports a typical chalk stream assemblage dominated by the keystone species *Ranunculus penicillatus ssp. Pseudofluitans.*
- Based on macrophyte community indices the resident macrophyte community is adapted to low flows and nutrient enrichment.
- The freshwater river reaches downstream of the Portsmouth Water source are unlikely to support typical chalk stream macrophyte communities due to the nature of the channel and the flow characteristics.
- Research into *Ranunculus sp* communities and *Ranunculus sp* growth patterns indicate that both are sensitive to velocity changes. *Ranunculus penicillatus ssp.*

Pseudofluitans has been shown to change morphology during growth in direct response to velocity changes and the typical chalk stream assemblages have been shown to change species composition in response to changing velocities in rivers.

- Well established optimum and acceptable velocity bands have been identified from a range of literature and research sources giving acceptable velocities for *Ranunculus sp.* growth between 0.1-0.3 m/s and optimal conditions between 0.3-0.5 m/s. Above 0.5 m/s, growth is sub-optimal, and plants may be susceptible to damage.
- Indicative calculations of velocities based on flow conditions in the river suggest that all but three cross-sections studied downstream of the Southern Water abstraction source are estimated to be above 0.3 m/s, both for the abstraction licence HOFs and the proposed Drought Order HOFs. At the three cross-sections where velocities are estimated to be below approximately 0.3 m/s, the velocity was still within the upper end of the acceptable range.
- The change in velocity between the abstraction licence HOFs and the proposed Drought Order HOFs is very small (approximately 0.01 to 0.02 m/s).
- Hydrological modelling using historic flow records and stochastic flow sequences show that the implementation of the Lower Itchen sources Drought Orders would be required very rarely, assuming that the Test Surface Water and Candover Augmentation Scheme Drought Orders have been implemented.

On the basis of the above assessment it is anticipated that although mechanisms exist for flow related impacts on macrophytes and their related communities, it is unlikely that there would be adverse effects on the *Ranunculus spp.* communities of the Lower Itchen as a result of the application of the Drought Orders. However, applying a precautionary approach, it not possible to conclude with absolute certainty that there would be no adverse effects on the Annex I designated feature (which incorporates the underlying chalk stream habitat as well as the macrophyte community) in extreme drought conditions with the Drought Order in place.

Atlantic salmon

Atlantic salmon are an Annex II species in the Habitats Directive which are present in the River Itchen SAC as a qualifying feature, but not a primary reason for site selection.

Baseline

River Itchen salmon have a relatively short life-cycle compared to non-chalk stream populations as described earlier. Atlantic salmon populations in the River Itchen are in unfavourable condition and have been in decline over recent decades. The EA calculate a Conservation Limit for salmon in the Itchen which is the approximate minimum number of adult spawning salmon required for a self-sustaining population of salmon. This Conservation Limit equates to approximately 660 returning adults[36]. The reasons for this low population size are thought to be due to several important factors including poor egg survival and poor marine survival. The concern is that a reduction in river flows may prevent or delay the movement of salmon into and through the river and that this could lead to increased losses or lower spawning success compared to fish entering and moving up the river promptly.

Potential flow related impacts

Due to the complexity of the Atlantic salmon life-cycle there is a concern that it is slow to recover from adverse changes in environmental conditions. Factors thought to be significant in the riverine habitat with respect to salmon survival are diffuse pollution, siltation of the salmon redds, summer low flow with respect to habitat suitability, entry to the river and

[36] Environment Agency (2004) River Itchen Sustainability Study, November 2004

migration up the river. In addition, deterioration in water quality (e.g. temperature, ammonia and dissolved oxygen) could also have direct physiological effects on Atlantic salmon.

Diffuse pollution issues are largely attributed to the Upper Itchen and beyond the potential impact of the application of the Drought Order.

Several studies have shown that spawning gravel areas of the River Itchen are in poor condition[37,38] with egg survival rates often less than 5%. The Environment Agency has initiated a programme of gravel cleaning on the Itchen to tackle this issue. High river flows help to clean the gravels and transport silt past the spawning gravels; however, the main spawning areas are largely upstream of Southern Water's Lower Itchen sources, so this is not considered to be a major issue for the implementation of the Drought Order.

The RISS study[39] noted that the success of river entry has been associated with a number of factors including low river discharge, high water temperatures and low dissolved oxygen[40,41] with river discharge also widely reported to influence upstream migration of salmon[42,43,44,45]. It is significant to note that it is unclear how salmon perceive changes in river discharge. Various hypotheses have been proposed including water velocity, the character of the water (smell or taste) or even the water temperature. At present there seems to be no clear consensus on this point. Considerable robust scientific analysis has been ongoing on the neighbouring River Test to investigate the relationship between river discharge (and associated metrics) and salmon movements within the river. While it is recognised that there is wide variation in the relationships between river discharge and upstream migration of salmon between different rivers[44,45] it is useful to consider the most recent outputs from this analysis in the context of River Itchen – which like the River Test is a river with a stable flow and a high base flow index (BFI).

Milner and Fenn[46] have concluded in relation to the River Test that:

- "flow-related control on salmon movement is not strong, for the Great Test. Moreover, there is evidence that in large, stable flow, high BFI rivers such as the Test, flow-migration responses may be inherently weaker compared to those exhibited by salmon in surface water fed rivers."

[37] Scott, A and Beaumont, W. R. C. (1993). Improving the survival rates of Atlantic Salmon (Salmo salar L.) embryos in a chalk stream. Institute of Fisheries Management. Annual Study Course: Cardiff (1993).
[38] Riley, W.D., Mason, C., Rowlatt, S.M., Maxwell, D., Campbell, S., Hull, S., (1998). The efficacy of River channel modification in maintaining improvements in salmonid spawning gravels following cleaning: final report. CEFAS - contract report CO224, pp 169.
[39] Environment Agency (2004) River Itchen Sustainability Study, November 2004
[40] Clarke D.R.K., Evans D.M., Ellery D.S., and Purvis W.K. (1994) Migration of Atlantic salmon (Salmo salar L.) in the River Tywi estuary during 1988, 1989 and 1990. NRA Cardiff, Report RT/WQ/RCEU/94/7, 1994
[41] Purvis, W., Crundwell, C. R., Harvey, D., Wilson, B. R., (1994), Estuarial Migration of Atlantic Salmon in the River Dee, North Wales. ETSU T/04/00154/REP Report by the National Rivers Authority for the Energy Technology Support Unit, pp. 134.
[42] Banks, (1969) A Review of the Literature on the Upstream Migration of Adult Salmonids. Journal of Fish Biology. Volume 1. Pp.85 - 136
[43] Hellawell J.M., Leatham H., and Williams G.I. (1974) The upstream migratory behaviour of salmonids in the River Frome, Dorset. Journal of Fish Biology. Volume 6, Issue 6, November 1974, pp 729–744
[44] Solomon, D.J, Sambrook, H.T., Broad, K.J, 1999. Salmon migration and river flow. Environment Agency R & D Publication 4. pp 110
[45] Baxter G. (1961) River utilization and the preservation of migratory fish life. Proc Inst Civil Eng 18:225–244
[46] Milner N. and Fenn C. (2017) Joint statement on the outcomes of and pointers from advanced regression and time series modelling of salmon migration count responses to flow in the Great Test. In: Test Enabling Works Phase 1 Scoping Report, Atkins for SWS

- No evidence was found of clear migration-inhibiting or migration-triggering thresholds (in flow or other variables) in the work carried out. For migration to occur, the enabling hydraulic conditions (notably water flow, depth and velocity) need to be present; but the occurrence of such enabling conditions does not mean that migration will occur. The indications are that rainfall and flow are partial influences that work in conjunction with other factors in a highly variable, and perhaps irreducible fashion.
- The evidence points to the conclusion that flow dynamics exert limited influence on the migration counts in the Great Test.

Indirect flow related impacts - temperature and dissolved oxygen

Salmonids in the UK's southern chalk streams are operating at the edge of their range particularly with regard to temperatures. Alabaster and Lloyd[47] identified temperatures above 20-21ºC as being damaging to salmonids and Shephard[48] suggested mortality occurs at temperatures greater than 23ºC. The acclimation of the fish and duration of exposure was important to the effect that was observed.

High river temperatures often coincide with low river discharge as dry summers often have high air temperatures. Studies on the neighbouring River Test indicated that temperature is largely dictated by air temperatures and that abstraction had minimal impact on water temperatures[49]

Alabaster *et al*[50] reported that water temperature was an important factor in determining the lethality of low dissolved oxygen concentrations. Salmon were able to survive dissolved oxygen concentrations of 3.2 mg/l at 15ºC but at 22.5ºC a dissolved oxygen concentration of approximately 5.7 mg/l was required for survival.

Water temperatures in the Itchen estuary show maxima of around 20-21ºC during July, August and September which could be problematical to the migrating salmon if deep cool water is not available for refuge. Nevertheless, dissolved oxygen concentrations found in the River Itchen estuary and Southampton Water are typically high (Environment Agency data show that dissolved oxygen concentration stayed above 6 mg/l throughout 2017 in the Test Estuary and Southampton Water) which suggests that they should provide some protection to the salmon.

Indirect flow related impacts - food availability

Juvenile Atlantic salmon grow rapidly in chalk streams due to the high abundance of macroinvertebrates as foods sources. They typically therefore only spend one year in the river as juveniles (Parr) before they migrate out to sea as smolts.

Studies from the Itchen and other rivers suggest that *Gammaridae and Baetidae* are important food supply to salmonids[51,52]. They are a particularly important food source in autumn and winter due to their higher abundance at this time[52]. Sodergren[53] concluded that a decrease in

[47] Alabaster J.S. and Lloyd R. (1982) Water Quality Criteria for Freshwater Fish. Butterworth-Heineman
[48] Shepard, S.L.(1995). Atlantic salmon spawning migrations in the Penobscot River, Maine- Fishways, flows and high temperatures. M.S. Thesis, University of Maine, Orono, ME. 111 p.
[49] Atkins, 2013. Lower River Test NEP Investigation
[50] Alabaste J.S., Gough P, and Brooker W.J. (1991) The environmental requirements of Atlantic salmon, Salmo salar L., during their passage through the Thames Estuary, 1982–1989, Journal of Fish Biology, Volume 38, Issue 5, May 1991, pp 741–762.
[51] Exley K. (2006) River Itchen Macro-Invertebrate Community Relationship To River Flow Changes, Environment Agency Report, October 2006
[52] MacNeil, C., Elwood, R.W. and Dick, J.T.A. (2000). Factors influencing the importance of Gammarus spp. (Crustacea: Amphidoda) in riverine salmonid diets. Arch. Hydrobiologia 149, 87-107.
[53] Sodergren, S. (1976). Ecological effects of heavy metal discharge in a salmon river. Report to the Institute of Freshwater Resources, Drottningholm 55, 91-131.

the population of juvenile salmon was directly related to reductions in the abundance of prey items (particularly winter growing Ephemeropteran nymphs such as *Baetis rhodani*).

Studies on the Itchen macroinvertebrate community suggested a flow threshold where the characteristic chalk stream community undergoes significant ecological change[54]. The initial community change is characterised by a drop in the typically very high abundances of the dominant taxa – particularly susceptible are the *Gammaridae* and *Baetidae*.

The HOF of 198 Ml/d near Eastleigh was devised to offer a sufficient level of protection to safeguard the River Itchen macroinvertebrate community. Reducing the flow to 160 Ml/d under the Lower Itchen sources Drought Order may result in some short-term stress on the macroinvertebrate community; however, evidence from the River Itchen over the last 16 years or so suggests that the macroinvertebrate community is able to recover fairly rapidly from the impacts of low flows once higher flows return. The impacts of a dry summer will be limited to one year assuming that flows in the following summer return to more normal levels[54].

Salmon are highly mobile and adaptable with regards to their food source; they are known to feed on *simulidae* and *chironomidae* which are abundant downstream of Southern Water's Lower Itchen sources and more tolerant of low flow conditions. Flows above Southern Water's Lower Itchen sources during droughts could be maintained initially by the implementation of the Candover Augmentation Scheme Drought Order and therefore *Baetidae*, which are drift species, should still be present in the drift community from upstream of the abstraction.

The implications of a reduced food supply for one season, as the result of drought conditions, could be to reduce the numbers and growth rate of Parr as a result of:

- A longer freshwater growing period required to reach the minimum weight and fork length to smoltify and begin migration out of the river.
- Larger territories required due to limited food supply and therefore a temporarily reduced carrying capacity. The carrying capacity for a river is the maximum number of fish that can be supported by the river. This is usually limited by competition because Parr are highly territorial.
- In some cases, fewer fish may result in greater survival in that year - partly due to reduced fish density, larger territories and therefore reduced competition.

There is currently no evidence of the impact of short-term declines in abundance of flow sensitive macroinvertebrate food sources on the salmon population. Macroinvertebrate communities recover rapidly from periods of drought and alternative low flow tolerant species will continue to be available as food sources. A reduction in the numbers and growth of Parr in one year is unlikely to have a significant impact on the returning stock estimates for the Itchen salmon population in the longer term and should not impact on the recovery of the Itchen salmon population.

Habitat Variable impacts

Table 6.6 (above) presents indicative calculations of velocities experienced in the river with flows at the abstraction licence HOFs and the Drought Order HOFs. While there are a number of uncertainties that need to be borne in mind, the calculations provide a reasonable indication of the sensitivity of velocities and depths to changes in low flow, and specifically the impact of flow reduction due to the Drought Order.

[54] Exley, K (2005). River Itchen macroinvertebrate community relationship to river flow changes. Environment Agency Report.

The results in Table 6.6 indicate that:

- Velocities at all cross-sections change very little with the implementation of the proposed Drought Order HOFs (never more than 0.04m/s). At the three sections where velocities are lowest (below approximately 0.3 m/s), the change in velocity due to the Drought Order is very small (approximately 0.01 to 0.02 m/s).
- Water depths at all cross-sections are suitable for fish passage even at the shallowest sections with the Drought Order HOFs in place. At the cross-section where the depth is estimated to be below approximately 0.4 m, the change in depth due to the Drought Order is very small (approximately 0.04 m).
- At several locations throughout the river downstream of the Southern Water Lower Itchen source with the Drought Order HOFs implemented, river depths are suitable for salmon holding up and salmon refuges are retained.

Assessment summary and conclusions

There are few empirical data currently available for the Itchen salmon populations on which to base this assessment. Consequently, the assessment has considered the likely frequency and duration of Drought Order implementation, hydrological effects and the wide range of environmental factors that influence salmon migration and survival.

The key findings are that:

- Atlantic salmon populations in the River Itchen are in unfavourable condition and not achieving conservation limits.
- The reasons for the poor performance of the Atlantic salmon population in the River Itchen are numerous and relate to spawning success and egg survival in the upper river, exploitation in marine and freshwaters and marine survival.
- Concern over the impact of the Drought Order largely relates to impact on the migration of salmon up the river and the potential for delays caused by low flow conditions.
- Robust statistical analysis of data on the neighbouring River Test indicates that there is evidence that in large, stable flow, high BFI rivers, flow-migration responses may be inherently weaker compared to those exhibited by salmon in surface water fed rivers.

Resumption of salmon upstream migration in Autumn (typically October) is largely driven by life-cycle factors (e.g. physiological readiness to spawn) – at this time of year only very small but distinct rainfall-induced flow increases trigger upstream migration. Drought conditions in the autumn period would affect these triggers, but abstraction would not remove these stimuli. Consequently, the effect of the Drought Order on the resumption of upstream salmon migration is only likely to be small.

- A hydraulic assessment of key river habitat variables during a 1:150-year drought conditions with the Drought Order HOFs in place indicates that:
    - Velocities at all sample cross-sections change very little due to the Drought Order (approximately of the order of 0.04 m/s). At the three cross-sections where velocities are lowest (below approximately 0.3 m/s), the change in velocity due to the Drought Order is very small (approximately 0.01 to 0.02 m/s).

  - Water depths at all cross-sections are maintained above approximately 0.4 m and unlikely to be limiting to fish passage or make a significant change to holding up pools on which the salmon rely.

- Itchen salmon are resilient to flow conditions prevalent in the river. Depleted salmon populations can recover well once drought pressures are removed from a single drought, repeated droughts may make recovery harder, but they will recover in due course.
- The marginal Drought Order effects over and above that of the natural drought conditions on the long-term resilience and sustainability of the Itchen salmon population will not be significant.

Whilst the assessment indicates that effects on Atlantic salmon will not be significant, adopting a precautionary approach, it is not possible to conclude with certainty that there would no adverse effects on this designated feature of the SAC.

Southern damselfly

The Southern damselfly *Coenagrion mercuriale* is a Habitats Directive Annex II species that is present in the River Itchen SAC as a primary reason for selection. The Southern damselfly *Coenagrion mercuriale* has a long aquatic larval stage lasting typically for two years in the UK and accounts for 95% of the Southern Damselfly life cycle[55]. During this phase they prefer small streams on heathlands and old water meadow ditch systems on chalk streams.

The Southern Damselfly is on the northern edge of its range in Britain, it is restricted mainly to the south and west of the country with population strongholds in the water meadow ditch systems along the Itchen Valley. Their distribution is discontinuous because their preferred habitat has undergone considerable fragmentation this century.

A previous study on the River Itchen[56] has suggested that larval southern damselflies were strongly associated with slow flowing, permanent water habitats in drainage ditches of the lower Itchen valley. Slightly less typically the aquatic larvae were present in macroinvertebrate samples at a monitoring site near to Gaters Mill on two occasions in 2005 and one in 2007; there are no other records of Southern damselfly in in-stream macroinvertebrate samples throughout the Lower Itchen

.

The aquatic larvae generally live amongst the roots and sediments of the marginal emergent vegetation. Soft-stemmed, submerged and semi-emergent herbs are favoured for oviposition whilst tall emergents with rigid upright stems are favoured for emergence.

Other habitats are characterised by ditches flowing through old water meadows, which themselves fall into the category of wet grassland and, where undermanaged, fen habitat. In these habitats there are two key elements that sustain the species. The nature of the ditches is critical, and that includes many abiotic attributes such as water level, water velocity, and water chemistry, and biotic factors such as the structure and composition of emergent and marginal vegetation. Although the implementation of the Drought Order will be very infrequent, when the Drought Order is in place there may be a reduction in and/or lowering of water levels that could impact upon these habitats.

[55] Purse B. (2002) The Ecology and Conservation of the Southern Damselfly (*Coenagrion mercuriale* – Charpentier) in Britain. EA R&D Technical Report W1-021/TR
[56] Environment Agency (2016) Renewal of the Candover Scheme Abstraction Licence: Part 2 – Environmental Sustainability

The terrestrial nature of these habitats also sustains the species during their relatively short adult stage; typically, and indirectly, by affecting the ditch, its physical structure and the water therein.

Most of the drainage ditches are supplied with water from the main River Itchen via flow control structures. Reduction in river flows due to the Drought Order could potentially reduce the availability of water in the main channel of the River Itchen and therefore limit the supply of water to the drainage ditch habitats, although water level management is likely to be the primary control on ditch levels.

Hydraulic assessment of the impact of the Drought Order on key river habitat variables (Table 6.6) indicates that:

- Velocities at all sample river cross-sections change very little due to the proposed Drought Order (approximately of the order of 0.04 m/s). At the three cross-sections where velocities are lowest (below approximately 0.3 m/s), the change in velocity due to the Drought Order is very small (approximately 0.01 to 0.02 m/s).
- Water depths at all sample cross-sections are maintained above approximately 0.4 m and are unlikely to be limiting to the macrophyte assemblages on which the Southern damselfly rely in the main river.

Due to small magnitude of the depth and velocity changes in the River Itchen, the incremental impact of the Drought Order beyond that of the prevailing baseline drought conditions in the river is anticipated to be small. Whilst the impacts of the Drought Order on the ongoing survival of the Southern Damselfly population are difficult to assess, they are unlikely to result in any adverse effects. However, applying a precautionary approach, it is not possible to completely rule out the potential for adverse effects on this designated feature.

Favourable Condition Tables (FCTs) for the River Itchen SAC

Based on the assessment of the potential effects on qualifying features scoped into the Appropriate Assessment, it is not possible to currently conclude with certainty that there would be no adverse effects on the relevant habitat and species objectives detailed in the Definitions of Favourable Condition for the River Itchen SAC.

With regard to the Favourable Condition Tables, the targets that could potentially be impacted by the Drought Order are considered to be:

- Habitat functioning: water flow - For Unit 105 and 106 -108 the targets are: <Qn95 (low flows) <5% and <10% deviation from daily naturalised flow respectively
- Biological community: Plant species composition and abundance - WFD LEAFPACS tool should give a result of high ecological status for the assessment unit.
- Extent and condition of breeding and foraging habitat of Southern damselfly - No more than 25% reduction in extent of larval habitat, i.e. areas of unshaded slow-flowing alkaline water with suitable substrate.
- Condition of breeding/larval habitat for the Southern Damselfly - Stable water supply, with water flowing throughout the year, indicated by runnels/ditches/carriers remaining between 1-10cm deep with discernible but not fast flow from spring
- Populations spatial extent for Atlantic salmon - There should be no reduction in densities from existing levels, and in any case no less than 0.2 m^2 in upland

rivers (source altitude >100m) and 0.5 m^2 in lowland rivers (source altitude ≤100m).

- Populations density of juvenile Atlantic salmon - There should be evidence of recent recruitment in each assessment unit.
- Populations density adult run size for Atlantic salmon - Total run size should achieve the Management Objective for returning salmon for the river. In addition, the seasonal pattern of migration should be characteristic of the river including the multi-sea-winter component.

Monitoring and Mitigation

Monitoring

Following discussions on the conclusions of this Appropriate Assessment of the Drought Plan 2019 with Natural England and the Environment Agency as part of the Hampshire Abstraction Licences Public Inquiry process and associated Section 20 Agreement, Southern Water agreed a package of monitoring measures to reduce the identified uncertainties in the environmental evidence pertaining to the Lower Itchen sources Drought Order. The package is provided in the Environmental Monitoring Plan (Annex 7 of the Final Drought Plan), but in summary the package includes:

- Targeted deployment of an appropriate proportion of the water quality monitoring stations
- Targeted deployment of an appropriate proportion of the water level monitoring gauge board installation
- Additional ecological sampling, fish monitoring and river habitat survey directly upstream and downstream of mitigation or compensation implementation, where this is necessary to supplement the agreed baseline monitoring of these features, including as necessary to supplement control site monitoring.

This monitoring package will be complemented by additional investigations, this work commenced in 2020, under the Water Industry National Environment Programme (WINEP) for the Itchen Valley wetlands, contributing to the improved evidence base.

Mitigation

In a similar manner to the monitoring programme, a package of mitigation measures has been agreed between Southern Water, Natural England and the Environment Agency to improve the environmental resilience of the River Itchen. The mitigation package is provided in the Environmental Monitoring Plan (see the draft Drought Plan 2022), but in summary the aim of the proposed mitigation measures is to:

- Improve habitat conditions and increase resilience of the River Itchen chalk stream community and associated wetland habitat to support ecology during and between low flow events which may be impacted by the use of a Lower Itchen sources Drought Order;
- Reduce the risk of Water Framework Directive deterioration caused by abstraction in droughts;
- Reduce the impacts of the Lower Itchen sources Drought Order on the environment where possible; and

- Reduce the risk of serious harm to the non-SAC SSSI features.

The package consists of:

- In-river restoration and mitigation measures for the Itchen, including a programme of measures aimed at increasing the resilience of the Itchen valley Southern damselfly (*Coenagrion mercuriale*) population.
- Catchment wide work aimed at addressing wider catchment pressures so as to increase resilience to synergistic and compounding effects. The programme of river restoration measures selected for implementation will be informed by reference to the Agency's report "Restoration measures to improve river habitats during low flows" (2016).

Additionally, monitoring (as set out in the Environmental Monitoring Plan – Annex 7) will be carried out during implementation of the Drought Order of designated features to allow dynamic management of mitigation measures to minimise the risk of adverse effects on designated features. This may involve temporarily modifying the abstraction rate, carrying out in-river modifications to protect designated features and addressing point and/or diffuse pollution risks that may identified by river walkover surveys.

Despite these mitigation measures being assumed to be in place, the Appropriate Assessment cannot currently conclude with certainty that they would be sufficient to avoid potential adverse effects on site integrity.

In-combination effects

i. Southern Water Candover Augmentation Scheme Drought Order

In developing the sequencing of the drought permit and order implementation as part of the Section 20 Agreement, preference is given to operating the Candover Augmentation Scheme drought order ahead of the Lower Itchen Sources drought orders. As such, the hydrological modelling completed has been undertaken in a cumulative manner i.e. Candover is operational within the model before the Lower Itchen Sources drought order. Therefore, no additional effects are anticipated.

ii. Southern Water Test Surface Water Drought Permit

The HRA for the Test Surface Water Drought Permit (dated December 2022) concluded that there was no mechanism for the River Test licence to affect any of the flora, fauna or geological or physiological features which are of special interest to the River Itchen SAC, except the Atlantic salmon qualifying feature.
The HRA concluded that *"…"*.

This assessment recognises that straying behaviour will occur in Atlantic salmon and that some natal River Itchen Salmon will stray to the River Test. It is accepted that any additional pressures in the Itchen Atlantic salmon population via this pathway are undesirable, but the scale of this must be assessed realistically and contextualised. There are unknowns and difficulties in carrying out the assessment, but as shown above, it has been possible to qualitatively assess the risk of effects from the Scheme on individual strays and to represent this in a quantitative assessment of impact on the Itchen Atlantic salmon population. This involves taking the range of values for the proportion of Itchen salmon returning stock estimate that stray into the Test 55 ZoI and estimating the proportion of those that are exposed to impact by the Scheme and from this provide an estimate of the egg losses within the River Itchen SAC.

Even in a scenario where a high number of strays are assumed (i.e. 10% straying rate which is considered plausible but still high) and an unreasonable assumption about the impacts of the Scheme on them are combined (i.e. a loss of 50% which is considered unreasonably high), this is still considered to exert no material effect on the sustainability of the River Itchen SAC's Atlantic salmon population. Whilst there might be some loss of River Itchen SAC Atlantic salmon egg deposition, as mentioned above, this is most unlikely to detectably reduce the population resilience or sustainability of the River Itchen SAC Atlantic Salmon population. Therefore, this appropriate assessment concludes with a sufficient degree of certainty that the Scheme's additional potential impacts while undesirable, are considered to be very small and based on the currently available evidence are shown to have no appreciable effect on the sustainability of the River Itchen SAC Atlantic salmon population, thereby causing no adverse effect on the integrity of the River Itchen SAC.

With operation of both the Test Surface Water drought permit and the Lower Itchen Sources drought order, there is potential for an increased impact to the Atlantic salmon population, with entry to two watercourses for spawning restricted, and spawning habitat potentially subject to temporary deterioration (e.g. fine sediment build up in gravels).
Further work completed by Milner and Fenn[57] on salmonid population on the River Test has concluded that:

- *"flow-related control on salmon movement is not strong, for the Great Test. Moreover, there is evidence that in large, stable flow, high BFI rivers such as the Test, flow-migration responses may be inherently weaker compared to those exhibited by salmon in surface water fed rivers."*
- No evidence was found of clear migration-inhibiting or migration-triggering thresholds (in flow or other variables) in the work carried out. For migration to occur, the enabling hydraulic conditions (notably water flow, depth and velocity) need to be present; but the occurrence of such enabling conditions does not mean that migration will occur. The indications are that rainfall and flow are partial influences that work in conjunction with other factors in a highly variable, and perhaps irreducible fashion.
- The evidence points to the conclusion that flow dynamics exert limited influence on the migration counts in the Great Test.

Studies on the River Test have also indicated that temperature is largely dictated by air temperatures and that abstraction has minimal impact on water temperatures[58].
Given the low risk of impact to the Atlantic salmon utilising the River Test, and the identified zone of influence of both drought schemes ceasing at the confluence of the watercourse and Southampton Water, no additional adverse effects on Atlantic salmon are considered likely during operation of both schemes.

There are still ongoing discussions with environmental regulators on the conclusions of the Test drought permit/order HRA and the environmental impacts of this, especially those around Atlantic salmon. The conclusions of the HRA were subject to change and, as set out in table 4.5, we have updated this HRA accordingly.

The potential for in-combination adverse effects on River Itchen SAC site integrity due to concurrent implementation of the Candover Augmentation Scheme Drought Order and the Lower Itchen sources Drought Order has been considered. The Appropriate Assessment of

[57] Milner N. and Fenn C. (2017) Joint statement on the outcomes of and pointers from advanced regression and time series modelling of salmon migration count responses to flow in the Great Test**.** In: Test Enabling Works Phase 1 Scoping Report, Atkins for SWS
[58] Atkins (2013), Lower River Test NEP Investigation

the Candover Augmentation Scheme Drought Order (Section 6.3 below) and the Lower Itchen sources Drought Order both conclude that adverse effects on chalk stream habitat and Southern damselfly features of the River Itchen cannot be ruled out. Consequently, there is potential for adverse effects on the integrity of the River Itchen SAC due to implementation of these Drought Orders, both alone and in combination with each other.

No other in-combination, adverse cumulative effects on site integrity have been identified in respect of this Drought Order.

Conclusions

Applying a precautionary approach, adverse effects have not yet been ruled out on Atlantic salmon, (this is one of the topics still subject to discussion with regulators) and cannot be completely ruled out as regards the Ranunculus habitat and the Southern damselfly designated features of the SAC and therefore on overall site integrity. No adverse effects on the other designated features of the SAC are anticipated.

Given that it is not possible to rule out adverse effects on site integrity, this Drought Order option needs to be taken forward to Stage 3 (Assessment of Alternatives) and, if it is concluded that there are no feasible alternative options, to Stage 4 (Assessment of Imperative Reasons of Overriding Public Interest (IROPI) and compensation measures) in accordance with Habitats Regulations Assessment process (see Part C of this HRA Report).

Assuming that Southern Water's IROPI case (as agreed by the EA in the Section 20 agreement) is accepted, the necessary compensation measures would need to address any potential adverse effects on:

- Approximately 36ha. of chalk stream habitat of the Candover Stream as identified through desk-based mapping of the habitat present within the impacted reaches of the River Itchen (spatial extent to be confirmed by site surveys)
- Approximately 9km of river in respect of the freshwater life-cycle stages of Atlantic salmon taking account of the braided nature of the lower River Itchen and based on desktop mapping assessment (spatial extent to be confirmed by site surveys).
- Approximately 15km of Southern damselfly habitat in the impacted reach of the River Itchen as identified through desktop mapping of potential suitable habitat (spatial extent to be confirmed by site surveys).

6.3 River Test Drought Permit

As mentioned in section 4.2, there are ongoing discussions with regulators relating to the River Test surface water drought permit project level HRA. The July 2024 project level HRA Appropriate Assessment (AA) for the River Test Drought Permit concluded that there was no likely significant effect for all European sites except for the River Itchen SAC. It found that for "*the River Itchen SAC, the assessment concludes that adverse effect on integrity cannot be excluded with certainty, at this juncture, with the various mitigation measures, as proposed. Further discussion with the EA on the mitigation measures is welcomed to progress this assessment*."

These ongoing discussions with regulators relating to the River Test surface water drought permit project level HRA indicated that the EA did not consider the mitigation proposed to be sufficient to prevent any potential adverse effects. Adopting the precautionary principle in relation to what may be functionally linked habitat, we have decided that this project level HRA will now progress to stage 3 and, if required, stage 4 of the HRA process. We wrote to the EA on 21 November 2024 to confirm this decision. This is part of the 'application ready' principles that we adhere to should such a drought option be needed in the future.

This process will need to be finalised before any River Test Drought Permit can be granted and implemented. We are currently expecting to conclude this process by summer 2025 and set out an indicative timeline for the process in table 4-7 of the main drought plan report. We shared this indicative timeline with the EA in December 2024. We will update the EA on the latest position with the project level HRA via the annual review process however we do not expect this ongoing process with the project level HRA to impact upon the finalisation of this drought plan.

6.4 Candover Augmentation Scheme

In order to protect public water supplies within Southern Water's Hampshire Southampton East Water Resources Zone in the event of a future severe drought, Southern Water may need to apply to the Secretary of State for a drought order to abstract water from the Candover Augmentation Scheme boreholes owned by the Environment Agency for subsequent discharge to the River Itchen downstream of the Candover Stream confluence. This flow augmentation would only be implemented during severe drought conditions when river flows in the River Itchen fall below 205 Ml/d.

The flow augmentation would enable Southern Water to continue to abstract water from its Lower Itchen sources for a longer period of time when river flows would otherwise fall below the abstraction licence Hands-Off Flow (HOF) condition of 198 Ml/d near Eastleigh. **Table 6.7** summarises the key components of the Candover Augmentation Scheme Drought Order.

The groundwater abstraction regime associated with the Drought Order would reflect the historic Environment Agency abstraction licence conditions, but Southern Water would construct a temporary pipeline from the current discharge location on the Candover Stream to allow the abstracted water to be discharged to the River Itchen upstream of Easton gauging station. The purpose of this would be to mitigate the risk of adverse effects on sensitive communities in the Candover Stream from a discharge of up to 27 Ml/d, and in particular to avoid flow augmentation impacts on the white-clawed crayfish population. The Drought Order would include the provision to use up to 5 Ml/d of the abstracted groundwater for release directly to the Candover Stream via the existing discharge infrastructure for the purposes of environmental support.

Table 6.7 Summary of Candover Augmentation Scheme Drought Order and the qualifying features of the SAC screened in for Appropriate Assessment

Candover Drought Order	
Drought Order details	When River Itchen flow falls below 205 Ml/d (as measured near Eastleigh), the Drought Order will allow Southern Water to abstract up to 27 Ml/d (limited to 20 Ml/d between 1 May and 31 August) from the Candover Augmentation Scheme boreholes. The existing augmentation scheme will be re-engineered so that

Candover Drought Order	
	the location of the main discharge is to the River Itchen downstream of the Candover Stream confluence, with provision for an environmental flow discharge of up to 5 Ml/d to the Candover Stream.
European sites screened in for Appropriate Assessment	River Itchen SAC
Qualifying features screened in for Appropriate Assessment	**River Itchen SAC** **Annex I habitats that are a primary reason for selection:** 3260 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:** 1044 Southern damselfly *Coenagrion mercurial* **Annex II species present as a qualifying feature, but not a primary reason for site selection:** 1092 White-clawed crayfish *Austropotamobius pallipes*

River Itchen SAC

In accordance with the Habitats Regulations, this Appropriate Assessment provides details and assesses the potential effects on those qualifying features of the River Itchen SAC that have been screened in for assessment (water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Southern damselfly and Atlantic salmon). Baseline Conditions associated with these features are discussed in Section 6.2.1.

Favourable Condition Flow Targets for the River Itchen SAC

Flow targets for the River Itchen SAC, derived primarily from an evaluation of macroinvertebrate communities[59], were developed as part of the Review of Consents process. These flow targets are discussed in more detail in Section 6.2.2

Favourable Condition Water Quality Targets for the River Itchen SAC

As discussed in Section 6.2.3, another of the Conservation Objectives for the River Itchen SAC (and favourable condition targets for the River Itchen SSSI) is to meet the Common Standards Monitoring Guidance targets for water quality. Whilst water quality is generally of a high standard (except for SRP which is generally good), the drought order may lead to a temporary deterioration in water quality, including when considered against the CSMG targets.

Candover Stream

The CSMG assessment for the Candover Stream (**Table 6.8**) has been carried out with data from the Candover Stream at Borough Bridge water quality monitoring site for the period 2005 to 2020 (consistent with the WFD assessments above) and using the specific CSMG targets agreed for the Candover Stream between Natural England and the Environment Agency.

The assessment concluded that, over the record period 2018-2020, compliance with the CSMG targets is achieved with respect to total ammonia, un-ionised ammonia, BOD (mean) and Dissolved Oxygen (10th Percentile).

[59] Exley, K (2005). River Itchen macroinvertebrate community relationship to river flow changes. Environment Agency Report.

SRP concentrations had previously failed but have generally been improving in recent years with mean SRP now compliant with CSMG targets for the monitoring period January 2018 to December 2020 following measures to improve phosphorus management in the catchment. This assessment will be updated in future with more recent water quality data once collected as part of the Candover Drought Order Monitoring Package and routine EA WFD monitoring activities.

Table 6.8 Compliance against agreed water quality CSMG standards for the Candover Stream

CSMG Parameter	CSMG Standards for Candover Stream WFD water body (GB107042022620)	Borough Bridge Water Quality (2018-2020)	Compliant?
Total ammonia (90th percentile)	0.25 mg/L	0.03mg/L	Compliant
un-ionised ammonia (95th percentile)	0.021 mg/L	0.001mg/L	Compliant
BOD (mean)	1.5 mg/L	1.12mg/L	Compliance
SRP (annual mean)	0.02 mg/L target	0.018mg/L	Compliant
SRP (March - September mean)	0.02 mg/L target	0.012mg/L	Compliant
Dissolved Oxygen (10th percentile)	85%	95.66%	Compliant

The drought order has the potential to lead to an increase in SRP from the baseline conditions and while now generally compliant with the CSMG target, there is a medium risk that the standard may temporarily not be achieved during drought order implementation.

There is a medium risk that lower river flows in the Candover Stream due to the drought order will lead to some temporary local reductions to dissolved oxygen levels in the impacted reach (and a possible increase to BOD) that will lead to a temporary departure from the CSMG target.

These risks to the CSMG targets may be mitigated by the proposed release of a mitigation flow to the Candover Stream of up to 5 Ml/d.

River Itchen at Easton

The CSMG assessment for the River Itchen at Easton (**Table 6.9**) has been carried out with data for the period 2005 to 2020 (consistent with the WFD assessments above) and using the specific CSMG targets agreed for Itchen WFD water body between Natural England and the Environment Agency.

The assessment concluded that, over the record period 2005-2020, compliance with the CSMG targets is achieved for all parameters except a minor non-compliance in respect of the SRP standards. However, SRP concentrations have generally been improving in recent years with mean SRP at 0.033 mg/L for the monitoring period 2016 to December 2020 following measures to improve phosphorus management in the catchment. This assessment will be updated in future with more recent water quality data once collected as part of the Candover Drought Order Monitoring Package and routine EA WFD monitoring activities.

Table 6.9 Compliance against agreed water quality CSMG standards for the River Itchen at Easton

CSMG Parameter	CSMG Standards for Itchen WFD water body (GB107042022580)	Easton Water Quality (2005-2020)	Compliant?
Total ammonia (90th percentile)	0.25 mg/L	0.09mg/L	Compliant
un-ionised ammonia (95th percentile)	0.021 mg/L	0.002mg/L	Compliant
BOD (mean)	1.5 mg/L	1.2mg/l	Compliant
SRP (annual mean)	0.03 mg/L target	0.05mg/L	Non-compliant
SRP (March - September mean)	0.03 mg/L target	0.035g/L	Non-compliant
Dissolved Oxygen (10th percentile)	85%	87.35%	Compliant

The drought order will involve the discharge of water to the River Itchen upstream of Easton and there is a negligible risk of the discharge leading to a deterioration in water quality against the CSMG targets based on current understanding of how the pipeline and discharge will operate. The precise details of the pipeline and whether it will be above or below ground, along with the precise discharge location are not yet confirmed so there is some uncertainty in this risk assessment; the planning application has been submitted but not approved to date (February 2021). The assessment will therefore be updated once the details are confirmed so that if there any potential risks identified they can be reviewed further.

Favourable Condition Tables for the River Itchen SAC

Definitions of Favourable Condition (DFCs) contained within Favourable Condition Tables (FCTs) are used to periodically measure and assess the condition of both notified SSSI features and designated European Site features. The definitions comprise one or more condition definitions for the special interest features at the specific site. These are subject to periodic review and may be updated to reflect new information or knowledge. DFCs are used by Natural England to determine if a site is in a favourable condition. The standards for favourable condition have been developed and are applied throughout the UK. Where SSSIs also form part of a European Site (such as a SAC or SPA), a separate document containing specific containing the Conservation Objectives is prepared (see below). The concepts of 'site integrity' and 'favourable condition' are similar and the assessment of a feature's condition will measure attributes that also represent aspects of a site's ecological integrity. This is because the DFCs do not represent a comprehensive or definitive list of all of the elements that might contribute to site integrity, merely those that are most appropriate to monitor in order to rapidly determine the present condition of a feature.

The FCTs include site specific habitat condition objectives and species objectives that should be considered as part of the Appropriate Assessment, as discussed further below.

Potential impacts on the physical environment due to the Candover Augmentation Scheme Drought Order

Implementation of the Candover Augmentation Scheme Drought Order would only occur during severe drought conditions and only for a temporary period (6 months initially, with the possibility of a further 6-month period of use). Water resources modelling indicates that the Drought Order would only be implemented during a severe drought with an approximate return period of 1 in 60-80 years.

The hydrogeological and hydrological effects of the Candover Augmentation Scheme drought order arising from groundwater abstraction have been evaluated using the Test and Itchen groundwater model for selected historical and synthetic extreme drought conditions. The modelling has provided information on the effects of the Drought Order on changes in groundwater levels, effects on the ephemeral and perennial reaches of the Candover Stream and hydrological effects on riparian wetlands. Further, more detailed information is provided in the accompanying Environmental Assessment Report that accompanies this Appropriate Assessment.

During implementation of the Drought Order (DO), there would be:

- A net gain in flow in the Candover Stream with the provision of the environmental flow release from the boreholes (of up to 5 Ml/d) to provide mitigation for reductions in river flow and/or water levels in surrounding wetlands that may otherwise arise due to the groundwater abstraction under the Drought Order (and in combination with nearby public water supply groundwater abstractions that affect the Candover Stream)
- A net gain in flow in the River Itchen from downstream of the discharge point to the Southern Water abstractions in the Lower Itchen (up to a maximum gain of 27 Ml/d when total groundwater abstraction is authorised to take place at a maximum rate of 27 Ml/d).

Groundwater modelling indicates, however, that following cessation of the Drought Order flow augmentation and environmental flow releases, there would be a slight reduction in flows in the Candover Stream (based on modelled flows at Borough Bridge) and to a lesser degree in the River Itchen (based on modelled flows at Easton), until groundwater levels wholly recover from the impact of the abstraction. This reduction in flow arises due to the suppression of the groundwater levels due to the abstraction under the Drought Order compared to baseline post-drought conditions. Consequently, greater groundwater recharge would be required before river flows start to recover after the drought. These effects could be partly mitigated through continuation of abstraction at up to 5 Ml/d to provide environmental flow releases to the Candover Stream with no commensurate downstream abstraction so as to also provide benefit to flows along the River Itchen.

At Easton, the augmentation flow is small compared with the normal dry year variation of flows in the River Itchen but, nonetheless, flows would be up to around 12% higher than the severe drought flow conditions that would occur without the Drought Order in place. Operation of the flow discharge to the River Itchen would involve a gradual increase in the discharge up to the full rate over a period of days. In addition, the discharge outfall to the River Itchen would be designed to avoid the risk of any local scour effects on the receiving river channel, including specific design features to dissipate energy and reduce turbulence (for example, through providing a series of broad width set of “cascade” steps at the outfall as commonly used for similar flow augmentation scheme discharge outfall structures), together with very localised river bed and bank protection measures using natural and/or geotextile materials if considered necessary. The outfall design will be agreed with the Environment Agency and Natural

England prior to installation to ensure the local river environment is protected. Monitoring of the outfall will also take place on initial operational testing to check for any potential issues and refinements can be made to the intake if the testing indicates this is necessary. Baseline surveys of the river channel at and downstream of the proposed discharge to the River Itchen should also be carried out to better assess the potential risks of local scour and downstream sediment entrainment as a result of the discharge to confirm that there would be no adverse effects on SAC designated features and supporting habitats between the discharge point and Southern Water's abstractions in the Lower Itchen.

As set out in the accompanying Environmental Assessment Report, the groundwater modelling results show that the Candover Augmentation Scheme Drought Order does not lead to any discernible change to the overall ephemeral character of the Candover Stream. The hydrological and hydrogeological modelling also concluded that there is unlikely to be any material adverse effects on the perennial stream, river flow regime or the wetland hydrology. In addition, there are unlikely to be adverse effects on hydromorphological processes in the receiving river channels or to river water quality in either the Candover Stream or River Itchen. However, there are some uncertainties in the groundwater modelling results and site surveys (allied to groundwater pump testing if feasible) would help to confirm the model findings, in particular improved baseline monitoring of river flows, groundwater levels and water levels in the wetlands. Whilst the 1970 to 2011 model output data is generally accepted as 'fit for purpose' and therefore used in the Environmental Assessment Report and supports this Appropriate Assessment, it is however recognised that there are local areas where, regardless of climate inputs, the modelled groundwater levels and stream flows are less well calibrated. Of particular note, the summer groundwater levels simulated beneath the Itchen SSSI Units 3 and 114 (wetland habitats) to the south of Grange Lakes on the Candover Stream and the upper end of the River Itchen, respectively, are lower than the mapped spring lines and appear out be of kilter with the perennial flow characteristics in these areas.

Potential effects on qualifying features scoped in to the Appropriate Assessment

Detailed assessment of the potential effects of the Candover Augmentation Scheme Drought Order on the qualifying features scoped in for assessment is provided in the Candover Augmentation Scheme Drought Order Environmental Assessment Report which should be read in conjunction with this Appropriate Assessment.

The HRA screening assessment concluded that the water-sensitive habitats/species that could be adversely affected by the Drought Order implementation were the chalk stream habitat, Southern damselfly and White-clawed crayfish. Assessment of the potential effects of the Drought Order on these features is presented below.

Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

The River Itchen is a classic example of a "Sub-type 1" chalk stream habitat. The river is dominated throughout by aquatic Ranunculus spp. The headwaters contain pond water-crowfoot *Ranunculus peltatus*, while two Ranunculus species occur further downstream: stream water-crowfoot *R. penicillatus ssp. pseudofluitans*, a species especially characteristic of calcium-rich rivers, and river water-crowfoot *R. fluitans*. The overall conservation status at a UK level of "Water courses of the plain to montane levels of Ranunculion fluitantis and Callitricho-Batrachion vegetation" is 'Bad' with an improving trend. The conservation status is not reported at a site level but the relevant site or feature condition of the underpinning SSSI for each SAC is used as an indicator and is the basis for the condition reporting to Defra.

The abundance of key macrophyte species in the Itchen SAC have been shown to be strongly related to river flow, although reach assemblage composition was often confounded by the influence of additional environmental variables. The limited baseline data available indicate that the macrophyte community associated with the Candover Stream and the reaches of the River Itchen upstream of Otterbourne were indicative of communities preferring low to moderate flow velocities with a preference for mesotrophic to eutrophic conditions. As for macrophytes, flow is the primary driver of trends in invertebrate abundance in the Itchen. In addition to flow, sedimentation and water quality are major drivers of the macrophyte community structure. With regards to Ranunculus growth, autumn and winter flushing of gravel beds are particularly important to ensure optimum growth of Ranunculus population during the following summer periods. A potential delay in recovery of groundwater levels and the subsequent impact on surface flow could therefore have a long-term impact on macrophyte communities. Increased flow velocities during low flow periods could also alter the macrophyte community.

As indicated, available data indicates that peaks in soluble reactive phosphorus concentrations are sometimes linked to low flow conditions within the Candover Stream. Any delay in recovery of flows could, therefore, result in water quality changes that may result in increased algal growth and alteration of the macrophyte community structure through an increase in species associated with eutrophic conditions. This is of particular concern should the drought order be operated in-combination with existing abstractions within the catchment.

The limited baseline data available indicates that the macroinvertebrate community associated with the Candover Stream shows a preference for moderate flow velocities. Low flows as a result of a delay in recovery in natural flows could favour taxa with a preference for slow flowing water, altering the baseline macroinvertebrate community structure. There is some uncertainty with regards to the impact of the discharge of colder water during drought conditions on surface temperatures within the Candover Stream. This change in temperature could potentially result in negative impacts on the macroinvertebrate community. The colder waters discharged in the Candover Stream could also potentially impact on the fish community associated with the watercourse. The availability of habitat for fish may also be altered through modification to the flow velocity, wetted width or depth of water, especially during a period of slow recovery in flow following the implementation of the augmentations scheme. The altered flow conditions and habitat availability could favour tolerant species and result in an alteration of the baseline fish community. Fisheries surveys in the Candover Stream indicates that the watercourse supports a typical chalk stream fish community.

While impacts on the chalk stream ecology could potentially be mitigated during the operation of the Drought Order through the gradual increase to the full discharge rate over a period of days, there remains uncertainty with regards to the impact on the physical environment as a result of the operation of the Drought Order. In addition, there remains uncertainty with regards to the impact on flows and water quality in the Candover Stream as a result of a delayed recovery of groundwater levels due to the additional groundwater abstraction authorised under the Drought Order. Based on the currently available data and evidence it is not possible to conclude no adverse effects on the Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation habitat in the perennial flowing reaches of the Candover Stream (approximately 6km) as a result of implementing the Drought Order.

White-clawed crayfish Austropotamobius pallipes

This species is spatially restricted to the restricted to the Upper Itchen tributaries, including the Candover Stream. It is not generally present in the River Itchen downstream of the Candover Stream, including the River Itchen reach affected by the Drought Order.

The environmental flow support to the Candover Stream as part of the Drought Order operation is unlikely to adversely affect the distribution of white-clawed crayfish through

potential flushing of individuals. The gradual build-up of the environmental flow release over a period of days will also protect any individual crayfish that may inhabit the river reach immediately below the discharge location.

However, there remains some uncertainty with regards to the potential impact of a delay in recovery of flows as a result of the Drought Order operation. The white-clawed crayfish population within the Candover Stream are known to be adapted to a stable flow regime characteristic of southern chalk streams and their annual life cycle is dependent on the existing variations in channel flow velocity[60]. As such, any delay in the recovery of river flows may potentially adversely impact on the white-clawed crayfish population.

Based on the available data and evidence it is not currently possible to conclude with certainty that the Drought Order will have no adverse effects on the White-clawed crayfish population in the perennial reaches of the Candover Stream, in particular the in-combination effects on river flow regime with other abstractions from the chalk aquifer.

Further monitoring of the white-clawed crayfish, water temperature and the stream flow effects of abstraction would help to reduce the uncertainties.

Southern damselfly *Coenagrion mercuriale*

Strong populations of Southern damselfly occur in the River Itchen catchment which represents one of the major remaining population centres in the UK. The species has not been found in the Candover Stream.

The Southern damselfly in the River Itchen SAC also represents a population in a managed chalk-river flood plain, an unusual habitat for this species in the UK rather than on heathland. A previous study on the River Itchen has suggested that larval southern damselflies are strongly associated with slow flowing, permanent water habitats in some of the drainage ditches of the lower Itchen valley. Slightly less typically, the aquatic larvae were present in macroinvertebrate samples taken at Gaters Mill (near to the tidal limit) on two occasions in 2005 and one in 2007. Data from the Environment Agency suggest that the species also occurs in low numbers at a number of locations on the main river channel itself between Twyford and Gaters Mill. Detailed surveys have indicated that the species is likely to be limited to the areas downstream of Winchester.

Changes to river flows within the Candover Stream due to the Drought Order will not result in any impacts on the Southern damselfly population. Changes to river flows in the River Itchen downstream of the discharge point are unlikely to affect the Southern damselfly but there is some uncertainty due to the limited data as to the presence of the species in the affected river reach. There is a low risk that the discharge of the water to the River Itchen could potentially adversely affect any Southern damselfly habitat that may be present in the main river channel downstream of the discharge point, notably in the area of favourable habitat – an approximately 2.5km of river reach upstream of Otterbourne. There is also a risk that the delay in recovery of flows following cessation of the drought order might potentially have an adverse effect on Southern damselfly habitat (if present and hydrologically linked to the affected reach of the River Itchen).

Further monitoring for the presence of Southern damselfly and habitat in the impacted reach of the River Itchen would help to reduce the uncertainty in this assessment.

Based on available data, it is not possible to currently conclude with certainty that there would be no adverse effects on the Southern damselfly habitat and population in the River Itchen upstream of Otterbourne and downstream of the Candover confluence (approximately 2.5km

[60] Hutchings, A.R. (2004). A review of the potential impacts of the Candover Stream Augmentation Scheme on the native crayfish population at Fobdown Farm near Alresford, Hampshire. Report prepared for the Environment Agency, Southern Region.

of habitat) due to the operation of the discharge to the River Itchen from the Candover Augmentation boreholes.

Favourable Condition Tables (FCTs) for the River Itchen SAC

Based on the assessment of the potential effects on qualifying features scoped in to the Appropriate Assessment, it is not possible to currently conclude with certainty that there would be no adverse effects on the relevant habitat and species objectives detailed in the Definitions of Favourable Condition for the River Itchen SAC.

With regard to the Favourable Condition Tables, the targets that could potentially be impacted by the Drought Order are considered to be:

- Habitat functioning: water flow - For Unit 105 and 106 -108 the targets are: <Qn95 (low flows) <5% and <10% deviation from daily naturalised flow respectively
- Biological community: Plant species composition and abundance - WFD LEAFPACS tool should give a result of high ecological status for the assessment unit.
- Extent and condition of breeding and foraging habitat of Southern damselfly - No more than 25% reduction in extent of larval habitat, i.e. areas of unshaded slow-flowing alkaline water with suitable substrate.
- Condition of breeding/larval habitat for the Southern Damselfly - Stable water supply, with water flowing throughout the year, indicated by runnels/ditches/carriers remaining between 1-10cm deep with discernible but not fast flow from spring
- Populations spatial extent for Atlantic salmon - There should be no reduction in densities from existing levels, and in any case no less than 0.2 m2 in upland rivers (source altitude >100m) and 0.5 m2 in lowland rivers (source altitude ≤100m).
- Populations density of juvenile Atlantic salmon - There should be evidence of recent recruitment in each assessment unit.
- Populations density adult run size for Atlantic salmon - Total run size should achieve the Management Objective for returning salmon for the river. In addition, the seasonal pattern of migration should be characteristic of the river including the multi-sea-winter component.
- White-clawed crayfish population extent - should reflect distribution under near-natural conditions.
- White-clawed crayfish population abundances - Shallow water: A mean of at least 5 out of 100 refuges containing white-clawed crayfish within a unit of assessment. Deep water: At least 1 individual caught per trap on average.
- White-clawed crayfish population structure - At least 20% of population should be <25 mm carapace length (CL), as evidence of recruitment. Approximately equal numbers of sexes in the adult population.

Monitoring and Mitigation

Monitoring

Following discussions on the conclusions of the Appropriate Assessment for the Drought Plan 2019 with Natural England and the Environment Agency as part of the Hampshire Abstraction Licences Public Inquiry process and associated Section 20 Agreement, Southern Water has agreed a package of monitoring measures to reduce the identified uncertainties in the environmental evidence pertaining to the Candover Augmentation Scheme Drought Order. The package is provided in the Environmental Monitoring Plan (Annex 7 of the Final Drought Plan), but in summary the aim of the monitoring package is to:

- Improve understanding of normal (non-drought) conditions in the Candover Stream, Upper River Itchen and the River Itchen SSSI wetland units;
- Improve understanding of the environmental sensitivity of the Candover Stream, Upper River Itchen and the River Itchen SSSI wetland units;
- Improve understanding of the impact of drought on the Candover Stream, Upper River Itchen and the River Itchen SSSI wetland units;
- Improve understanding of the ecological and environmental impact of implementation of the Candover Augmentation Scheme Drought Order;
- Monitor effectiveness of mitigation measures (see below).

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The package includes:

- Hydrometry and water quality monitoring measures
- Monitoring to gather geological, hydrological and ecological baseline data about the River Itchen SSSI wetland units
- Invertebrate and macrophyte monitoring in the Candover stream and River Itchen upstream of the Lower Itchen abstraction
- White-clawed crayfish (*Austropotamobius pallipes*) monitoring programme
- Targeted 'walkover' surveys.

This monitoring package will be complemented by additional investigations, commenced in 2020, under the Water Industry National Environment Programme (WINEP) to assess the impact of public water supply groundwater abstractions within the groundwater zone of influence of the Drought Order, as well as the allied WINEP investigation programme for the Itchen Valley wetlands, both of which will contribute to the improved evidence base.

Mitigation

In a similar manner to the monitoring programme, a package of mitigation measures has been agreed between Southern Water, Natural England and the Environment Agency to improve the environmental resilience of the Candover Stream and River Itchen. The mitigation package is provided in the Environmental Monitoring Plan (Annex 7 of the Final Drought Plan), but in summary the aim of the proposed mitigation measures is to:

- Improve habitat conditions and increase resilience of the River Itchen and Candover stream community and associated wetland habitat to support ecology during and between low flow events, including events compounded by the Candover Augmentation Scheme Drought Order;

- Reduce the impacts of the Candover Augmentation Scheme Drought Order on the environment where possible;
- Reduce the risk of Water Framework Directive deterioration caused by abstraction in droughts.

The package consists of:

- A suite of in-river mitigation measures primarily aimed at increasing the resilience of the white-clawed crayfish (*Austropotamobius pallipes*) population in the Upper Itchen tributaries.
- Catchment wide work aimed at improving habitat and species resilience to drought conditions in the Upper Itchen. The programme of river restoration measures selected for implementation will be informed by reference to the Environment Agency's report "Restoration measures to improve river habitats during low flows" (2016).

Additionally, several mitigation measures have been identified for implementation during operation of the Drought Order to minimise the risk of adverse effects on designated features:

- Provision of the environmental flow release to the Candover Stream of up to 5 Ml/d to address any reduction in river flow and/or water levels in surrounding wetlands that may otherwise arise due to the in-combination effects of the groundwater abstraction with public water supply groundwater abstractions
- Requirement to gradually increase (and decrease/cease) the augmentation flow release to the River Itchen and the environmental flow release to the Candover Stream over a period of days

Consideration to be given to continuing environmental flow releases to the Candover Stream following cessation of the use of the augmentation flows to the River Itchen (provided that the Drought Order has not already expired) to help manage the flow regime in the Candover Stream and downstream River Itchen during the period of potentially delayed groundwater recovery.

- Construction Environmental Management Plan for the construction of the outfall discharge and associated pipework adjacent to the River Itchen to ensure no adverse effects on the water environment, including measures to prevent pollution and sediment runoff.
- Monitoring (as set out in the Environmental Monitoring Plan) during implementation of the Drought Order of designated features to allow dynamic management of mitigation measures to minimise the risk of adverse effects on designated features. This may involve temporarily modifying the environmental flow discharge rate and/or the augmentation flow rate, carrying out in-river modifications to protect designated features and addressing point and/or diffuse pollution risks that may identified by walkover surveys.

Despite these mitigation measures being assumed to be in place, the Appropriate Assessment cannot currently conclude with certainty that they would be sufficient to avoid potential adverse effects on site integrity Further work on the detailed design of the discharge arrangements to the River Itchen is being carried out and the HRA will be updated once the detailed design is available as part of a project-level HRA. At this stage, there remains some uncertainty as to

the conclusion of no adverse effect on the River Itchen SAC from the discharge pending finalisation of the design and any necessary mitigation measures to protect designated features.

The Integrity Test

The integrity of the site is: "*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified*"

Based on available information, at this time it cannot be concluded that the Candover Augmentation Scheme Drought Order will not have an adverse effect on site integrity.

In-combination effects assessment

Other Public Water groundwater abstractions in the groundwater zone of influence
The main uncertainties surrounding the effects assessment for the Candover Augmentation Scheme Drought Order centre on the potential for adverse in-combination effects on site integrity with nearby existing licensed public water supply groundwater abstractions, in particular the cumulative effect on groundwater levels in the chalk aquifer during a severe drought and the resultant delay in the recovery of river flows following cessation of the drought order. Additional monitoring is recommended to confirm the findings of the groundwater modelling that the in-combination effects of the Drought Order and existing public water supply abstractions would be negligible. Investigations planned to be carried out from 2020 under the Water Industry National Environment Programme (WINEP) in relation to these public water supply groundwater abstractions, as well as the allied WINEP investigation programme for the Itchen Valley wetlands, will contribute to the improved evidence base.

Southern Water Lower Itchen sources Abstraction Licence and Portsmouth Water Lower Itchen Abstraction Licence
There would be no adverse in-combination effects on site integrity with these licensed abstractions from the Lower Itchen when operating in accordance with the Hands-Off Flow conditions of 198 Ml/d (Southern Water licences) and 194 Ml/d (Portsmouth Water licence).

Lower Itchen sources Drought Order
The potential for in-combination adverse effects on River Itchen SAC site integrity due to concurrent implementation of the Candover Augmentation Scheme Drought Order and the Lower Itchen sources Drought Order has been considered. The Appropriate Assessment of the Lower Itchen sources Drought Order (Section 6.2 above) and the Lower Itchen sources Drought Order both conclude that adverse effects on chalk stream habitat and Southern damselfly features of the River Itchen cannot be ruled out. Consequently, there is potential for adverse effects on the integrity of the River Itchen SAC due to implementation of these Drought Orders, both alone and in combination with each other.

Additionally in 2023 Stage 2 Appropriate Assessment for Solent Maritime SAC, Solent and Southampton SPA and Ramsar and assessment of Solent & Dorset SPA are presented in Section 6.7 and 6.9 (below). The appropriate assessment concluded:

- With the Candover Drought Order allowing the downstream HoFs at Allbrook and Highbridge, and Riverside Park to be maintained, and therefore *de*

minimis effects on the Lower Itchen, there will be no in-combination effect on the Solent EMS with the preceding sequence of actions agreed in the s.20 agreement.

No other in-combination, adverse cumulative effects on site integrity have been identified in respect of this Drought Order.

Conclusions

Overall, it is considered that, based on available evidence, adverse effects cannot be ruled out on the conservation objectives of certain qualifying features of the River Itchen SAC and therefore on overall site integrity. Consequently, the Drought Order needs to be taken forward to Stage 3 (Assessment of Alternatives) and, if there are no feasible reasonable alternative options, to Stage 4 (Assessment of Imperative Reasons of Overriding Public Interest (IROPI) and compensation measures) of the Habitats Regulations Assessment process (see Part C of this HRA Report).

Southern Water's IROPI case (as agreed by the EA in the Section 20 agreement), accepted in 2019, outlined that compensation measures would need to address potential adverse effects on:

- White-clawed crayfish population in the perennially flowing reaches of the Candover Stream only
- Approximately 6km of chalk stream habitat of the Candover Stream as identified through dialogue with the Environment Agency and the Hampshire and Isle of Wight Wildlife Trust as part of the Public Inquiry process in March-April 2018 (spatial extent to be confirmed by site surveys)
- Approximately 2.5km of Southern damselfly habitat in the impacted reach of the River Itchen as identified through dialogue with the Environment Agency and the Hampshire and Isle of Wight Wildlife Trust as part of the Public Inquiry process in March-April 2018 (spatial extent to be confirmed by site surveys).

6.5 Caul Bourne WSW Drought Permit

In order to protect public water supplies within Southern Water's Isle of Wight Water Resources Zone in the event of a future severe drought, Southern Water may need to apply to the Environment Agency for a Drought Permit to increase abstraction from its Caul Bourne WSW sources. **Table 6. 11** summarises the key components of the Caul Bourne WSW Drought Permit - further details are set out in the draft Drought Plan and accompanying Caul Bourne WSW Environmental Assessment Report and Habitats Regulation Assessment.

The scope of the Appropriate Assessment of the effects of the Drought Permit on European sites has been developed from the conclusions of the HRA screening assessment (as reported in Sections 4 and 5 above). A summary of the qualifying features screened in for the Appropriate Assessment is provided in **Table 6.11** i.e. those qualifying features sensitive to the effects of the Drought Permit where the HRA screening assessment was unable to confirm there would be no likely significant effects on site integrity.

Table 6.11 Summary of proposed Caul Bourne WSW Drought Permit and Appropriate Assessment scope

Caul Bourne WSW Drought Permit	
Drought order details	The Drought Permit would authorise Southern Water to increase abstraction at Caul Bourne WSW by reducing the Minimum Residual Flow requirement in the Caul Bourne from 4 l/s (0.3 Ml/d) to 2 l/s (0.15 Ml/d) as well as temporarily removing the constraint that limits abstraction to 40 Ml (1.3 Ml/d) within a 30-day period when the river flow at Calbourne gauging stations falls below 20 l/s (1.7 Ml/d). The revised abstraction would legally be authorised for a maximum of 6 months. Use of the drought permit powers would be removed sooner if water resources have returned to adequate levels to safeguard future water supplies, as agreed with the EA.
European sites screened in for Appropriate Assessment	Solent Maritime SAC Solent and Southampton Water SPA Solent and Southampton Water Ramsar site
Qualifying features screened in for Appropriate Assessment	Solent Maritime SAC *Annex I habitats listed are water dependent habitats although predominantly marine/ estuarine rather than freshwater. Low flows may affect the salinity regime in transitional waters and may therefore impact the following species and habitats, which have been identified as being sensitive to hydrological changes in the SIP and are scoped into the HRA:* *H1130 Estuaries.* *H1140 Mudflats and sandflats not covered by seawater at low tide.* *H1310 Salicornia and other annuals colonizing mud and sand.* *H1320 Spartina swards (Spartinion maritimae).* *H1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae).* Solent and Southampton Water SPA Article 4.1 Breeding: • Common tern *Sterna hirundo* • Little tern *Sterna albifrons* • Mediterranean Gull *Larus melanocephalus* • Roseate tern *Sterna dougallii* • Sandwich tern *Sterna sandvicensis* Article 4.2: Over winter: •Eurasian teal (*Anas crecca*) •Black-tailed godwit *Limosa limosa islandica* •Dark-bellied Brent goose *Branta bernicla bernicla* •Ringed plover *Charadrius hiaticula*. Article 4.2 An internationally important assemblage of birds: •Regularly supports waterfowl populations including Eurasian teal, black-tailed godwit, dark-bellied Brent goose and ringed plover. Assemblage qualification: A wetland of international importance. • Solent and Southampton Water Ramsar site Ramsar criterion 1:

Caul Bourne WSW Drought Permit	
	The site is one of the few major sheltered channels between a substantial island and mainland in European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs. Ramsar criterion 2: Important assemblage of rare plants and invertebrates represented on site: At least thirty three British Red Data Book invertebrates and at least eight British Red Data Book plants are represented within the site. **Ramsar criterion 5:** Assemblages of international importance: Species with peak counts in winter: 51343 waterfowl. **Ramsar criterion 6:** Qualifying Species/ populations (as identified at designation): Species with peak counts in spring/ autumn: Ringed plover *(Charadrius hiaticula)* Europe/Northwest Africa 397 individuals, representing an average of 1.2% of the GB population. Species with peak counts in winter: Dark-bellied brent goose (*Branta bernicla bernicla*) 6456 individuals, representing an average of 3% of the population; Eurasian teal *(Anas crecca)* NW Europe 5514 individuals, representing an average of 1.3% of the population; Black-tailed godwit *(Limosa limosa islandica),* Iceland/W Europe 1240 individuals, representing an average of 3.5% of the population.

Conservation Objectives and Site Improvement Plan measures

Conservation objectives have been set for the Solent Maritime SAC (and Solent and Southampton Water SPA) which are of relevance to Newtown Estuary:

> "*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*."

Supplementary Advice was published in March 2019 and information is available as part of the European Marine Site Conservation Advice, reference has therefore been made to the

original Regulation 33 advice available[61], the UK Marine SACs Project (completed in 2001)[62] and the attributes and targets detailed on Natural England's designated sites view.

Site Improvement Plans (SIPs) have also been developed for each Bern Convention Emerald site in England as part of the Improvement Programme for England's Emerald sites (IPENS). The plans provide a high-level overview of the issues (both current and predicted) affecting the condition of the Emerald Site features on the site(s) and outline the priority measures required to improve the condition of the features. It does not cover issues where remedial actions are already in place or ongoing management activities which are required for maintenance. A total of 17 issues have been prioritised for the Solent Maritime SAC[63] (and also for the Solent and Southampton Water SPA). The prioritised issues and affected features that may be relevant to the assessment of the proposed Drought Order are as follows (edited to relate to measures for habitats and species known to be present or potentially present in the Newtown estuary only):

- **Water pollution** should not impact the following species or habitats: A026(NB) little egret, A046a(NB) dark-bellied Brent goose, A048(NB) common shelduck, A050(NB) wigeon, A052(NB) Eurasian teal, A054(NB) pintail, A056(NB) shoveler, A069(NB) red-breasted merganser, A137(NB) ringed plover, A141(NB) grey plover, A144(NB) sanderling, A149(NB) dunlin, A156(NB) black-tailed godwit, A157(NB) bar-tailed godwit, A160(NB) curlew, A162(NB) common redshank, A169(NB) turnstone, A176(B) Mediterranean gull, A191(B) sandwich tern, A192(B) roseate tern, A193(B) common tern, A195(B) little tern, H1310 glasswort and other annuals colonising mud and sand, H1320 cord-grass swards, H1330 Atlantic salt meadows and the water bird assemblage.
- **Hydrological changes** should not impact on: H1150 coastal lagoons, H1320 cord-grass swards, H1330 Atlantic salt meadows.
- **Change to site conditions** should not impact on: A026(NB) little egret, A046a(NB) dark-bellied Brent goose, A048(NB) common shelduck, A050(NB) wigeon, A052(NB) Eurasian teal, A054(NB) pintail, A056(NB) shoveler, A069(NB) red-breasted Merganser, A137(NB) ringed Plover, A141(NB) grey plover, A144(NB) sanderling, A149(NB) dunlin, A156(NB) black-tailed godwit, A157(NB) bar-tailed godwit, A160(NB) curlew, A162(NB) common redshank, A169(NB) turnstone, A176(B) Mediterranean gull, A191(B) sandwich tern, A192(B) roseate tern, A193(B) common tern, A195(B) little tern, H1310 glasswort and other annuals colonising mud and sand, H1320 Cord-grass swards, H1330 Atlantic salt meadows and water bird assemblage.

Designated sites

As set out in **Table 6.11**, there are qualifying features relating to three European sites that have been scoped in for the Appropriate Assessment of the Caul Bourne WSW Drought Permit:

- Solent Maritime SAC

[61] Solent European Marine Site comprising: Solent Maritime Candidate Special Area of Conservation, Solent and Southampton Water Special Protection Area & Ramsar Site, Chichester and Langstone Harbours Special Protection Area & Ramsar Site, Portsmouth Harbour Special Protection Area & Ramsar Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994. October 2001. Accessed at http://publications.naturalengland.org.uk/publication/3194402.
[62] UK Marine SACs Project (2001). Accessed at http://www.ukmarinesac.org.uk/index.htm.
[63] Natural England (2014). Planning for the Future Improvement Programme for England's Natura 2000 Sites (IPENS) Site Improvement Plan: Solent. www.naturalengland.org.uk/ipens2000

- Solent and Southampton Water SPA
- Solent and Southampton Water Ramsar site

The Drought Permit has the potential to affect the Newtown estuary component of these European sites only, and specifically the Shalfleet Creek system of the estuary which receives freshwater flow inputs from the Caul Bourne river. Flows in the Caul Bourne may be reduced as a consequence of the Drought Permit, leading to a change in the freshwater flows to the Shalfleet Creek.

Hydrological Assessment

Baseline

The Drought Permit may impact on freshwater flow inputs to the Newtown River estuary due to the increased abstraction from groundwater which supports baseflow in the Caul Bourne river, a freshwater tributary to Newtown estuary.

The Drought Permit will not affect any other parts of the European sites and consequently this Appropriate Assessment only considers the potential effects on the Newtown River estuary component of the sites.

Assessment

The potential hydrological impact of the Drought Permit on the transitional water body of the Newtown River has been assessed taking account of the impact assessment above and with reference to assessments carried out under the Atkins (2014) Habitats Directive study.
Freshwater inflows from the Caul Bourne into Shalfleet Creek need to be considered in the context of the tidal regime, with large daily variations in salinity as the creek ranges from fully freshwater influence at low tide to fully saline conditions at high tide. The influence of the Caul Bourne therefore follows the tidal cycle with no apparent influence during high tide for most of the time. However, the salinity signal in Shalfleet Creek during high tide can be occasionally suppressed as a result of short duration, large magnitude freshwater “freshets” (flushes) that occur during the operation of the mill structures upstream (specifically at Calbourne Mill).

Using the highly precautionary NDD, the current Fully Licensed conditions (i.e. flows at Q_{95} and with the abstraction constraint at Caul Bourne WSW in place) would result in an estimated flow at the Calbourne Gauging Station of 1.5 Ml/d. Under the Drought Permit abstraction rate of 2.48 Ml/d, flows are predicted by the NDD methodology to decrease to 0 Ml/d**.** This provides a worst-case scenario for assessing changes to the freshwater influx into the estuarine system. Flow accretion in the Caul Bourne arising from the tertiary deposits downstream of the Calbourne gauging station assessment point, have been estimated at 0.77 Ml/d at Q_{95} flows in the Atkins 2014 Habitats Directive study. As such, predicted freshwater flow into the Shalfleet Creek under the proposed Drought Permit is estimated to 0.77 Ml/d at Q_{95} flow conditions. Freshwater inflows from the Caul Bourne under normal abstraction licence conditions have been estimated to be 1.38 Ml/d at Q_{95}. Freshwater inflows to the transitional water body at Q_{95} flows are therefore estimated to be reduced by approximately 44% as a result of the Drought Permit.

Owing to the uncertainty of connectivity between the aquifer and the surface waters during drought conditions, there is some uncertainty as to the impact of the Drought Permit on the Caul Bourne, and thus on the transitional waterbody. The relationship between the Chalk-sourced flows and the freshwater flows to Shalfleet Creek is not direct and is influenced by factors relating to water sourced from the Tertiary Deposits as well as the management of flows in the river at the mill structures. Calculations undertaken by Atkins (2014) suggest that

under Q_{95} flow conditions, the flow derived from the Tertiary Deposits was of a similar magnitude to the flows from the Chalk.

During low flow conditions, under normal licence constraints, abstraction reduces river flow at Calbourne, but accretion flows and discharges downstream of the Calbourne gauging station act to augment flows in the lower reaches. The effects of normal operation of the Calbourne Mill results in an intermittent freshwater influx (freshets) to the estuarine system at Shalfeet Creek. The primary impact of the Drought Permit in this context will be to extend these periods of mill pond recharge, and thus the periods of no freshwater influx. Mill operations appear to have a larger influence over flows in the Caul Bourne, and therefore freshwater flows into the estuary at Shalfleet Creek, compared to abstraction impacts from pumping at Caul Bourne WSW.

In the context of the impact on the Caul Bourne, and of the influence of the mill operations, it is understood that the main hydrological impact of the Drought Permit on the estuary would be a reduction in freshet frequency, owing to possible alteration in the mill operations. This reduction could lead to less frequent suppression of salinity at high tide, alongside a possible reduction in wetted width of the upper Shalfleet creek at low tide.

Taking account of the above analysis, the magnitude of impact of the Drought Permit on the transitional Newtown River water body is assessed as **major (uncertain).**

Water Quality Assessment

Baseline

Newtown Harbour has been designated both a Sensitive Area (Eutrophic) and a Polluted Water (Eutrophic). The evidence base to support the designations included the widespread growth of macroalgae *Enteromorpha* spp. and *Ulva* spp. Surveys undertaken by the Environment Agency between 2001 and 2003 recorded the macroalgae covering 33 to 63ha of the intertidal area. Surveys completed in 2008, 2012 and 2015 also recorded high coverage of macroalgae with 45-61% of the available intertidal area being covered. Hotspots for seasonal issues with macroalgae include the upstream reaches of Shalfleet Creek and Causeway Lake, with these two sites being included in the Environment Agency monitoring programme.

During a review completed by the Environment Agency in 2016, it was concluded that dissolved oxygen sags and phytoplankton blooms were not issues in Newtown Harbour, and therefore any mitigation efforts should be focussed on addressing the nutrient loading and macroalgae blooms[64]. The review also concluded that the estuary is hypernutrified and nitrogen concentrations exceed the standards for compliance with the Urban Waste Water Treatment Directive, although levels have been relatively stable for the last 25 years with no evidence of a reduction in the estuary or tributaries.

The biggest contributor of nitrogen (~40%) is from direct freshwater diffuse agricultural sources. Approximately 29% of nitrogen is from offshore coastal background sources and 27% is from indirect rivers and STW inputs via offshore. The remainder (<4%) is from direct STW inputs. Nutrient control measures have been put in place with the aim of reducing loading in the harbour.

[64] Environment Agency (2016) DATASHEET: Nitrate vulnerable zone (NVZ) designation 2017 – Eutrophic Waters (Estuaries and Coastal Waters). NVZ Name: Newtown Harbour.

To support the HRA and Environmental Assessment Report, water quality analysis for the estuary was undertaken based on the data available at the Shalfleet Quay Slipway (Y0004445) water quality monitoring site. There are very limited water quality data pertaining to Dissolved Inorganic Nitrogen (DIN). Newtown Estuary has been shown to be nitrogen limited, and since 2009, DIN status has been moderate (EA, 2015). The most affected part of the estuary is the Shalfleet Stream, which receives direct inputs from the Caul Bourne stream. In the absence of adequate Dissolved Oxygen concentration data at this water quality monitoring site, the analysis was based on Dissolved Oxygen saturation instead. Dissolved oxygen concentration measurements were thoroughly compliant with the WFD standard to support high status (70% saturation) for fish and invertebrates. Clear seasonality in Dissolved Oxygen is obvious, although no concurrent flow data were available in order to establish any links between saturation and flow.

Assessment

A review of the Environment Agency's catchment data explorer site (EA, 2021) indicates that the wider water body (Caul Bourne) was at high WFD status with respect to Ammonia in 2016 and considering the hydrological impact of the Drought Permit, the risk of water quality deterioration linked to total ammonia is assessed as low within both streams, assuming they will maintain some flow. Based on Environment Agency monitoring data and secondary evidence discussed above, the risk of deterioration to DIN concentrations within the Newtown estuary (Shalfleet Stream) is assessed as low, depending on the hydrogeological conditions at the time of the drought. The risk therefore does not arise from the lack of flow inputs to the Newtown estuary, as this is in fact likely to lessen or completely stop nutrient inputs to the estuary via Caul Bourne stream. The key issue arises from the timing of a potential post-drought flushing of nutrients to the estuary which will not occur simultaneously once the aquifer is reconnected to the stream. The implementation of the Drought Permit is therefore likely to impact Newton Estuary by exacerbating the accumulation of nutrients in the unsaturated zone, but there is some uncertainty with regards to the timing and extent of nutrient input and whether this is likely to result in a significant adverse impact on the estuary. The risk of groundwater qualitative status deterioration is considered low, with some degree of uncertainty.

A review of the Environment Agency's catchment data explorer site (EA, 2021) indicates that the wider water body (Caul Bourne) was at high WFD status with respect to Dissolved Oxygen in 2016 and 2019. Considering the hydrological impact of the Drought Permit, the risk of water quality deterioration linked to dissolved oxygen is assessed as low within both streams (assuming they will not dry up). A negligible risk is expected for Newtown River estuary, although this is uncertain given the lack of a clear relationship between freshwater flow inputs and dissolved oxygen saturation.

A review of the Environment Agency's catchment data explorer site (EA, 2021) indicates that the wider water body (Caul Bourne) was at moderate WFD status with respect to Soluble Reactive Phosphate (SRP) in 2016 and 2019. Considering the hydrological impact of the Drought Permit, the risk of water quality deterioration linked to SRP is assessed as low (assuming both streams maintain some flow).

Summary of Potential Impacts: Hydrology and Physical Environment

Table 6.12 summarises the potential effects on the physical environment due to implementation of the Drought Permit as identified in the accompanying Caul Bourne WSW Drought Order Environmental Assessment Report. Additional Drought Permit groundwater abstraction during low river flow conditions may reduce flows in the Caul Bourne river due to impacts on the headwater streams.

Table 6.12 Summary of potential changes to the physical environment due to the proposed Caul Bourne WSW Drought Permit

Caul Bourne headwater streams	
Flows ***Major impact***	• Drought Permit could reduce flows at the gauging station by 2 l/s • Risk of the stream drying completely, and low flow conditions experienced earlier and for an increased duration. Delay in flow recovery post-drought.
Water quality ***Low** risk*	• Low risks in relation to dissolved oxygen, ammonia and phosphate
Consented discharges ***Negligible** risk*	• Consented discharges considered to have negligible impact
Geomorphology ***Moderate** risk*	• Moderate risks to wetted width and associated habitat availability. Moderate risks to increased fine grained sedimentation. Negligible risk of bank collapse due to clay in the catchment
Newtown River (Transitional waterbody) including Shalfleet Creek	
Flows ***Major***	• Freshwater inflows would be reduced by 0.61 Ml/d at Q95 flows, from 1.38 Ml/d to 0.77 Ml/d • Drought order could lead to a reduction in the freshet flow frequency owing to alteration in mill operations. • Possible reduction of suppression of salinity at high tide and reduction of wetted width of the upper Shalfleet Creek at low tide
Water quality ***Low** risk*	• DIN – Uncertain impact based on secondary evidence; SRP – low (uncertain); Dissolved Oxygen – negligible (uncertain)
Consented discharges ***No** risk*	• No consented discharges identified that would impact this water body

Solent Maritime SAC

Baseline

The estuary, mudflat and sandflat and the Atlantic salt meadows habitat qualifying features have been scoped into the Appropriate Assessment in relation to the Newtown estuary component of the SAC

Assessment

H1130 Estuaries

Freshwater inflows at Q_{95} flows are estimated be reduced by approximately 44% as a result of the Drought Permit, from 1.38Ml/d without the Drought Permit to 0.97Ml/d with the Drought Permit, which is considered to be a **major (uncertain)** hydrological impact. A reduction in freshwater flow fails the attribute and target to maintain natural freshwater flow / volume into the estuary.

The supplementary advice states that "*retaining natural transitions from river to sea and upper to lower shore are important to a healthy estuary structure. Habitat zonation will be representative of the limits and range of estuarine communities with tidal movements and salinity*". A reduction in freshwater inflow could lead to the lengthening of the saline portion of the estuary, with the saline gradient moving upstream. A shift in isohalines with the salinity gradient moving upstream is likely to affect any tidal freshwater marsh or saltmarsh with a

freshwater reliance in the upper part of the estuary. The distribution of vegetation and sessile and benthic organisms within the saltmarsh and mudflat habitats could be altered with saline tolerant species moving further upstream. Reductions in water quality as a result of an increase in flushing time could lead to algal blooms, with localised increases in temperature as the cooling effect of the freshwater input is lost and smaller body of water heating more quickly. A reduction in water flow could lead to localised deposition of fine sediment, with the overall suspended solid load likely reduced and an upstream migration of the turbidity maximum (as the area where the salt wedge of saline intrusion meets with the fresh water influx, resulting in flocculation of suspended particulate matter).

The impact would be temporary lasting for the duration of the Drought Permit and lag time for recovery of the groundwater aquifer and therefore a 'lasting effect' which would result in the permanent loss of a qualifying habitat or species, or the 'long term deterioration' of the habitats or species within the estuary is considered unlikely. The effect of the Drought Permit is considered to be a large-scale change (volume of freshwater) but implemented over a short-medium term timescale to a localised area of the upper estuary in Shalfleet Creek. Specific mitigation is detailed in the following sections for the underlying habitats, and therefore it is considered that there will be no adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded in the medium-long term.

H1330 Atlantic salt meadows

The key impact of the Drought Permit is to reduce the freshwater input to the transitional waterbody. The resulting effects are considered to be:

- Potential increase in exposure at low tide as a result of a reduction in wetted area and possible desiccation of communities.
- Shift in isohalines with a change in distribution of vegetation (e.g. upstream migration of *Spartina* species) and sessile and benthic organisms[65].
- Shift in saltmarsh zones with reduction in pioneer communities as a result of smothering from finer sediments deposited as a result of low flows and velocities[66].
- Changes in water chemistry parameters – temperature, dissolved oxygen and dissolved and particulate matter leading to changes in water quality.
- Increase in flushing or freshwater transit time resulting in a build-up of nutrients and pollutants, with an increased risk of algal blooms.
- Increased influence of tide on circulation patterns as a result of reduced freshwater input.

Using the Supplementary Advice, it is considered that the following attributes/targets could be impacted by the Drought Permit, over and above the prevailing drought conditions:

- Structure and function: vegetation structure - zonation of salt marsh vegetation: Maintain the full range of zonations (low-mid, mid, mid-upper and transitional zones) between component saltmarsh communities found in H1330 (Atlantic salt meadows).
- Supporting processes: sedimentary processes: Maintain the sedimentary processes (suspended sediment, sediment transfer, etc.) that sustain the elevation and topography of the marsh surface.
- Supporting processes: water quality: Where the feature is dependent on estuarine water, ensure water quality and quantity is restored to a standard that provides the necessary conditions to support the feature.

[65] Gilbert, S., K. Lackstrom, and D. Tufford. 2012. The Impact of Drought on Coastal Ecosystems in the Carolinas. Research Report: CISA-2012-01. Columbia, SC: Carolinas Integrated Sciences and Assessments.
[66] Tyler-Walters, H., 2001. Saltmarsh (pioneer). In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 08-03-2019]. Available from: https://www.marlin.ac.uk/habitat/detail/25

The Newtown Harbour SSSI Favourable Condition Tables also include the following attribute and target that could be impacted by the Drought Permit, over and above the prevailing drought conditions:

- Pioneer, middle and upper saltmarsh communities: Indicators of local distinctiveness – maintain distinctive elements and current extent/levels and/or in current locations (e.g. maintain existing populations of notable species, important structural attributes or notable transitions between habitats).

This assessment considers the potential effects of the physical environmental changes set out above on the qualifying features scoped in for assessment. **Table 6.13** summarises the potential effects on the Atlantic salt meadow due to implementation of the Drought Permit.

Table 6.13 Potential effects on Atlantic salt meadows habitat

PLAN NAME: Southern Water Drought Plan 2022
OPTION NAME: Caul Bourne

Potential Effect	Significance	Monitoring	Specific Mitigation	Effect (on conservation objectives and site integrity)
Habitat degradation – exposure and desiccation	There are communities of herbaceous halophytic (salt-tolerant) plants growing on the margins of tidally inundated shores. The key requirements for the development of Atlantic salt meadows include: • a reasonable supply of sediment and a low energy wave environment. • twice-daily tidal cycles. • sediment transport across the shore. • sediment accumulation. • establishment of salt tolerant plants. Patches of *P. maritima* dominated saltmarsh habitat conforming to the Atlantic salt meadows habitat (1330), have been mapped throughout the Newtown estuary, with the majority of the habitat located in tidally influenced areas. A relatively small component of this habitat is located at the northern end of Shalfleet Creek and described as mixed mid-level saltmarsh[67]. This habitat is species rich and represents a fine example of this mid-level saltmarsh community which is comparatively uncommon in the Solent. The habitat develops when halophytic vegetation colonises soft intertidal sediments of mud and sand in areas protected from strong wave action. The vegetation forms the middle and upper reaches of saltmarshes, where tidal inundation still occurs but with decreasing frequency and duration. These habitats are less dependent on freshwater flow inputs and are mostly driven by tidal processes. A small reduction in the wetted area of the channel is considered likely at low tide as a result of the reduced river flows from the Caul Bourne (0.61 Ml/d reduction in Q95 flows) due to the Drought Permit. This could lead to exposure of previously waterlogged soils at low tide. *P. maritima* is restricted to waterlogged soils and could therefore be outcompeted by more terrestrial species in localised areas. The MarLIN sensitivity assessment also looks at the sensitivity of saltmarsh to desiccation as a result of drought. The overall sensitivity is considered to be low, as a result of intermediate intolerance (some loss of species and reduction in viability of population) but a high recoverability (recovery will take many months, but less than 5 years). The majority of the saltmarsh habitat is situated above the mean low water level and therefore impacts of a reduced wetted area are considered to be localised to a small area in the upper estuary. The duration of the effect will be intermittent and restricted to low water, with areas submerged again at higher tides. The impact is considered to result in a small-scale change (wetted width), with intermittent effect over a short-medium term timescale to a localised area of the upper estuary in Shalfleet Creek. Any increase in exposure will occur at low tide only, and for the limited duration of the Drought Permit; 6 months. The frequency of the Drought Permit implementation is low; no more frequently than once in every 180-200 years. Furthermore, the WRMP19 is aiming to introduce measures on the Isle of Wight that will reduce this frequency further during the second half of the 2020s.	<u>Monitoring</u> The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and Environment Agency): • Flow monitoring within Shalfleet Creek. • Wetted area measurements. • Walkover survey of Shalfleet Creek to assess the level of low tide hydrological features and connectivity with the habitats (mudflats/sandflats). • Habitat mapping. • Survey to confirm hydrological connectivity to Shalfleet Creek and carry out a baseline water quality survey for soluble reactive phosphorus (SRP), dissolved oxygen, salinity, temperature and conductivity at spring low tide ideally in hot weather conditions. <u>Modelling</u> • Use IoW groundwater model to confirm assessment impacts (if available; currently in development with Environment Agency).	Investigate changes to the operation of Calbourne Mill to optimise flows during implementation of the Drought Permit.	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Species loss – shift in communities	*Salinity* Mudflats and saltmarshes are reliant on a salinity regime to function and support the resultant communities. The salinity gradients zone the flora and fauna found across the saltmarshes and intertidal mudflats. Salinity is also an important parameter in saltmarsh root growth including its ability to influence plant nitrogen assimilation and sediment nitrogen retention, which in turn influences the stability of the marsh[68]. The MarLIN sensitivity assessment has concluded that saltmarsh species are tolerant of a range of salinities, typically within the range of 18-40psu, although the pioneer communities are tolerant of greater salinities than the upper marshes. The habitat is considered to have a low sensitivity to changes in salinity, with intolerance being low (species unlikely to be killed, but overall viability reduced) but a very high recoverability (full recovery within a couple of weeks and less than 6 months).	<u>Monitoring</u> The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and Environment Agency): • Flow monitoring within Shalfleet Creek. • Wetted area measurements. • Walkover survey of Shalfleet Creek to assess the level of low tide hydrological features and connectivity with the habitats (mudflats/sandflats). • Habitat mapping. • Survey to confirm hydrological connectivity to Shalfleet Creek and carry out a baseline	• Continued compliance with nitrogen stripping at Pennington STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Progression with work on phosphorous limits at Caul Bourne WTW and Shalfleet WTW, included in WINEP for delivery in 2024. • Investigate changes in operation of Calbourne Mill to	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[67] Jonathan Cox Associates (2013). Shalfleet Creek Isle of Wight vegetation and botanical survey. July 2012.
[68] Alldred M, Liberti A and Baines S.B. (2017) Impact of salinity and nutrients on salt marsh stability. Ecosphere. Accessed at https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2010.

Potential Effect	Significance	Monitoring	Specific Mitigation	Effect (on conservation objectives and site integrity)
	The vegetation survey completed for the Atkins 2014 Habitats Directive Review of Consents study concluded that "*Narrow strips of saltmarsh fringe the banks of Shalfleet Creek. These display well developed and classic transitions from the freshwater influenced marshes at the head of the creek and landward edge of the lateral saltmarsh platforms. This gives way to more mixed higher salinity marshes further north and towards the outer edge of the lateral saltmarshes*". The report goes on to conclude that "*The main axis of the transition is from south to north ranging from the brackish coastal communities of M28* [*Iris pseudacorus – Oenanthe crocata* mire] *and SM28* [*Elymus repens* saltmarsh] *at the southern end of the creek to more saline influenced marsh communities such as SM16* [*Festuca rubra* saltmarsh] *and ultimately SM13* [*Puccinellia maritima* saltmarsh] *towards the northern end of the creek*". The northern most area of saltmarsh sampled as part of the study was on the western bank opposite the Corf Scout Camp site (SZ41469021). It is understood that one of the main changes to the hydrological regime as a result of the Drought Permit, including the influence of the mill operations, would be a reduction in freshet frequency. The reduction in freshwater input is predicted to lead to a very limited change in saline intrusion distance upstream. This is not considered to result in an adverse impact as the freshwater-influenced species are subject to only infrequent freshwater inundation (between 2-9% of the year) during high river flow events which will not be affected by the Drought Permit. With a decrease in freshwater input into Shalfleet Creek there is the potential for the community composition to follow the salinity gradient, with more saline tolerant species replacing those requiring greater freshwater inputs in the upper estuary. The impact is considered to be low; a small area over which the effect could be experienced (pioneer and lower marsh), for a short-medium term timescale to a localised area of the upper estuary in Shalfleet Creek.	water quality survey for soluble reactive phosphorus (SRP), dissolved oxygen, salinity, temperature and conductivity at spring low tide ideally in hot weather conditions. <u>Modelling</u> Review of impacts following revised hydrology assessment using IoW model.	optimise flows during implementation of Drought Permit.	
Habitat degradation - changes to groundwater flow	Work completed between 2011 and 2012 and reported on in 2014 as part of the Habitats Directive Review of Consents follow up study, identified a second source of freshwater into the saltmarsh creek system; lateral surface water drainage from the valley sides. Surveys identified some communities commonly associated with freshwater inflows and some of the saltmarsh habitats also contain abundant wild celery *Apium graveolens* which is indicative of freshwater influence[69]. The source of this water is understood to be from small gravel aquifers perched on the underlying clays of the Hamstead Beds and Bembridge Marls, rather than from the Chalk itself. Flow accretion in the Caul Bourne arising from the tertiary deposits downstream of the Calbourne gauging station assessment point, have been estimated at 0.77 Ml/d at Q_{95} flows in the 2014 study. As such, predicted freshwater flow into the Shalfleet Creek under the proposed Drought Permit is estimated to be 0.77 Ml/d at Q_{95} flow conditions i.e. no change and therefore negligible impacts. However, there is general uncertainty over the connectivity between the aquifer and the surface waters during drought conditions. Groundwater models can help understand this groundwater–surface water interaction and can be used to help quantify impacts on surface water flow and identify critical reaches. The Isle of Wight groundwater model was commissioned by Southern Water and will be available for further assessment if required in 2022.	<u>Modelling</u> • Use IoW groundwater model to confirm assessment impacts (if available; this has been in development with Environment Agency	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Degradation of habitat – sedimentation	The Drought Permit may affect the Atlantic salt meadows in Shalfleet Creek via a reduction in sediment supply from the freshwater Caul Bourne due to reduced velocities as a result of the lower river flows. There may be increased sedimentation within the upper reach of sand and silt grade material due to lower velocities, and a reduction of sediment further downstream. However, flow velocities in the Caul Bourne would already be low prior to Drought Permit implementation due to natural drought conditions and therefore the movement of sediment would already be minimal. The risk of reduced sediment delivery due to the impact of the Drought Permit is therefore assessed as low. As the Atlantic salt meadows are predominately dependant on tidal and marine processes, impacts of the Drought Permit relating to reduced fluvial sediment supply and reduced freshwater flows to the estuary (over and above those arising due to natural drought conditions) are assessed as negligible. Any sediment deposited should be mobilised when higher flows return post-drought.	None required.	None required.	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Degradation of habitat – water quality	*Temperature and Oxygen* Dissolved oxygen saturation/concentration data were consistent with the standard to support high status for fish and invertebrates in the transitional water. The risk of water quality deterioration with respect to Dissolved Oxygen is therefore assessed as low. The Environment Agency review for the Sensitive Area (E) and Pollution Waters (E) designations also concluded that dissolved oxygen sags were not an issue in the estuary.	None required	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[69] Atkins (2014) Isle of Wight HD Implementation Monitoring Investigation Caul Bourne Hydrological Monitoring Summary Report. Prepared for Southern Water Services.

Potential Effect	Significance	Monitoring	Specific Mitigation	Effect (on conservation objectives and site integrity)
	Therefore, although small, temporary changes could occur to the temperature and dissolved oxygen levels due to implementation of the Drought Permit, significant adverse impacts on the saltmarsh and mudflat habitats are considered unlikely due to the resilience of the intertidal communities and existing Dissolved Oxygen saturation supporting a high status for fish and invertebrates.			
	Nutrient Loading As discussed in the water quality baseline conditions, nitrogen loading in the estuary is a key issue with macroalgae blooms occurring across the mudflats. This in turn can create anoxic conditions underneath reducing the diversity and abundance of the invertebrate community and potentially interfere with bird feeding patterns[70]. Saltmarsh root growth can be restricted by raised salinity and low oxygen concentrations in the soil reducing the plants ability to acquire sufficient quantities of phosphorous and nitrogen[71]. Increased nitrogen and phosphorous loading on saltmarshes can alter the species composition and accelerate the successional stages, with those plant species characteristic of more fertile sites becoming dominant and those species of less nutrient rich sites, and typical of the early successional stages, being outcompeted[72]. Nitrogen loading, and eutrophication, also reduces the growth of saltmarsh root and rhizome systems, thereby affecting the stability of the marsh[73]. The hydrological assessment concluded the risk of deterioration to Dissolved Inorganic Nitrogen (DIN) within the estuarine reach is low, however uncertain due to the lack of data. The reduced dilution of nutrients and increased flushing time may increase the area of saltmarsh covered by algal mats, and potentially cause a temporary shift in species abundance and composition in the lower marsh as a result of the change in nutrients, compounded by the change in salinity regime. The recovery time required for the groundwater aquifer to contribute baseline flows to flush through the nutrients could allow the algal blooms to persist longer into the autumn months. The amount of algal cover affecting the saltmarsh communities will need to be confirmed through baseline survey as no data is currently available. The majority of the saltmarsh habitat is situated above the mean low water level and therefore any effects of changes to nutrient levels, temperature and Dissolved Oxygen are considered to be limited to the pioneer and low marsh zones. The impact is therefore considered to be low; a small area over which the effect could be experienced (pioneer and lower marsh), for a short-medium term timescale to a localised area of the upper estuary in Shalfleet Creek.	<u>Monitoring</u> The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and Environment Agency): • DAIN monitoring in Shalfleet Creek. • Additional water quality monitoring for soluble reactive phosphorous (SRP), dissolved oxygen, salinity, temperature and conductivity. • Extent of algal mat cover on lower marshes. • Species abundance and composition in the lower marshes. <u>Modelling</u> Review of impacts following revised hydrology assessment using IoW model.	• Continued compliance with nitrogen stripping at Pennington STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Progression with work on phosphorous limits at Caul Bourne WTW and Shalfleet WTW, included in WINEP for delivery by 2024. • Investigate changes in operation of Calbourne Mill to optimise flows during implementation of Drought Permit.	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Intra-order effects	Multiple individual effects on the saltmarsh habitat have been identified as a consequence of the reduction in freshwater input to the estuary. The effects will act synergistically, on the same receptor at similar times to potentially increase the overall effect of degrading the saltmarsh habitat. However, the combined effects are not sufficient to cause a long-term change in the saltmarsh community, or affect a large extent being limited to the upper estuary. The overall viability of the saltmarsh is not considered to be adversely affected in the long-term with the impacts reversible in the short-medium term when freshwater inputs are restored.	As above	As above	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[70] http://www.ukmarinesac.org.uk/pdfs/sandmud.pdf
[71] Saltmarsh Review JNCC Report 334
[72] Van Wijnen H.J. and Bakker J.P. (1999) Nitrogen and phosphorous limitation in a coastal barrier saltmarsh: the implications for vegetation succession. Journal of Ecology.
[73] Alldred M, Liberti A and Baines S.B. (2017) Impact of salinity and nutrients on salt marsh stability. Ecosphere. Accessed at https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2010

H1140 Mudflats and sandflats not covered by seawater at low tide

The key impact of the Drought Permit is to reduce the freshwater input to the transitional waterbody. The resulting effects are considered to be:

- Reduction in water levels with a reduced wetted area at low tide.
- Reduction in flow, velocities and sediment input leading to potential changes in sedimentation patterns.
- Change in location of salinity/freshwater interface with potential migration upstream.
- Changes in water chemistry parameters – temperature, dissolved oxygen and dissolved and particulate matter leading to changes in water quality.
- Increase in flushing or freshwater transit time resulting in a build-up of nutrients and pollutants.
- Increased influence of tide on circulation patterns as a result of reduced freshwater input.

Using the Supplementary Advice, it is considered that the following attributes/targets could be impacted by the Drought Permit, over and above the prevailing drought conditions:

- **Structure and function: presence and abundance of key structural and influential species** – [Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.
- **Supporting processes: energy / exposure** – Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure [High / Medium / Low] does not cause alteration to the biotopes, and stability, across the habitat.
- **Supporting processes: physico-chemical properties** – Maintain the natural physico-chemical properties of the water.
- **Supporting processes: water quality - dissolved oxygen** – Maintain the dissolved oxygen concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.
- **Supporting processes: water quality – nutrients** – Restore water quality to mean winter dissolved inorganic nitrogen levels at which biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features.
- **Supporting processes: water quality – turbidity** – Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.

The Newtown Harbour SSSI Favourable Condition Tables does not include any specific attributes and targets for the mudflat habitat.

With regard to the Favourable Condition Tables in the Regulation 33 information, the targets that could be impacted by the Drought Permit are considered to be:

- **Extent (ha)** – Loss of intertidal mudflat communities is likely to be detrimental to the structure of the interest feature, e.g. associated with a change in sediment budget or geomorphological regime and may indicate long term changes in the physical conditions of the estuaries interest.
- **Nutrient enrichment** - macroalgal mats - Nutrient status is a key functional factor that influences biota associated with sediments, including fauna as well as plants/algae at the surface. Certain macroalgae (e.g. Enteromorpha and Ulva spp.) can act as indicators of elevated nutrient levels which can reduce the quality of the sediments

and their communities, primarily through smothering and deoxygenation. The duration of the algal mats on the surface of the sediments is also important.

- **Sediment character** -particle size analysis - Sediment character defined by particle size analysis is key to the structure of the feature and reflects all of the physical processes acting on it. Particle size composition varies across the feature and can be used to indicate spatial distribution of sediment types thus reflecting the stability of the feature and the processes supporting it.
- **Range and distribution of characteristic mud biotopes**, for example: LMU biotopes - The variety and location of biotopes is an important structural and functional aspect of the feature. Littoral mud biotopes such as LMU.HedScr, LMU.HedStr and LMU.HedMac often support a high number of polychaete worms and bivalve molluscs, which form an important food source for birds and marine predators such as fish.

The mudflat habitat recorded within the Newtown estuary is most sensitive to changes in freshwater flow within the uppermost parts of Shalfleet Creek. The two biotope complexes within Shalfleet Creek (LS.LMu.UEst within the upper parts and LS.LMu.MEst within the lower parts of the creek) have been assessed by the MarLIN[74] sensitivity project, and the impacts highlighted therein have been considered in the context of the likely hydrological impact associated with the Drought Permit. Both biotope complexes are considered to have a low degree of sensitivity to salinity decrease and siltation rate changes (linked with migration of the turbidity maximum). As such, possible salinity increase at low tide is considered of limited impact. The biotope complex LS.LMu.MEst is considered to be sensitive to changes in water clarity (associated with a reduction in suspended solids, impacting on resource availability for suspension feeders).

Table 6.14 summarises the potential effects on the mudflats and sandflats not covered by seawater at low tide due to implementation of the Drought Permit.

[74] The Marine Life Information Network - MarLIN' - online information network of the Marine Biological Association of the UK

Table 6.14 Potential effects on mudflats and sandflats

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		PLAN NAME: Southern Water Draft Drought Plan 2022 OPTION NAME: Caul Bourne		
Potential Effects	Significance	Monitoring	Specific Mitigation	Residual Effects After Mitigation
Degradation of habitat – exposure and desiccation	The mudflat habitat recorded within the Newtown estuary is more sensitive to changes in freshwater flow within the uppermost parts of Shalfeet Creek. The lower shore normally remains saturated during low tide. With exacerbated low flow conditions due to the implementation of the Drought Permit (44% reduction in freshwater flow at Q_{95}), there is likely to be a small reduction in the wetted area of the channel in the upper Shalfleet Creek at low tide. This could lead to a greater area of mudflats becoming drained, and the sediment becoming firm and compacted, with a smaller saturated zone. Many of the species of the mudflats live in burrows and are capable of retreating into these burrows during periods of exposure, and thereby providing protection from desiccation. *Hediste diversicolor* inhabits a burrow approximately 0.3m deep and *Tubificoides benedii* is capable of burrowing to depths of approximately 10cm. Abundance of the latter is suggested to be driven by a decrease in high water level or an increase in the length of time the substrate is not covered by water. Increased emergence has been found to cause a decline in abundance of *Hediste diversicolor* at the upper limits of the intertidal zone, as a result of substrate drying and greater extremes of temperature. However, *Hediste diversicolor* are mobile enough to migrate to damper substrates. An increase in emergence as a result of the Drought Permit during low flows at low tide could decrease the upper shore extent of *Hediste diversicolor*. However, the biotope overall is considered to have a high resistance and high resilience, and therefore is not considered to be sensitive to changes in emergence. The zone of influence determined through the hydrological assessment has identified a likely downstream limit for the effects of Drought Permit; the confluence of Shalfleet Lake with Western Haven and Causeway Lake. The area of mudflats that could be subject to increased exposure within this zone of influence is up to approximately 10ha[75]. This is 0.20% of the total mudflats area (5,059.4ha) identified in the SAC citation[76]. However, the actual area is likely to be less as it will be limited to the low flow channel, and this will already be reduced due to the natural drought conditions. The structure of the mudflats is unlikely to change because of the temporary increased exposure; however, the sedentary benthic invertebrate communities could be at risk of increased desiccation. This could lead to a localised, temporary change in the species distribution, diversity and abundance of the mudflats.	<u>Monitoring</u> The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and Environment Agency): • Flow monitoring at within Shalfleet Creek. • Wetted area measurements. • Walkover survey of Shalfleet Creek to assess the level of low tide hydrological features and connectivity with the habitats (mudflats/sandflats). • Habitat mapping. • Benthic coring to establish community distribution, diversity and abundance: pre, during and post drought. • Survey to confirm hydrological connectivity to Shalfleet Creek and carry out a baseline water quality survey for soluble reactive phosphorus (SRP), dissolved oxygen, salinity, temperature and conductivity at spring low tide ideally in hot weather conditions. <u>Modelling</u> • Use IoW groundwater model to confirm assessment impacts (if available; currently in development with Environment Agency).	Investigate changes to the operation of Shalcombe Mill to optimise flows during implementation of the Drought Permit.	No adverse effect to the SAC integrity, and the ability to meet the favourable conservation status will not be impeded.
Degradation of habitat – sedimentation	In the upper estuary (Shalfleet Creek), there may be increased sedimentation of sand and silt grades. These changes in sediment size and mobility may change species numbers and richness, although mudflat species have a greater tolerance for different particle sizes and a high bioturbatory therefore being less sensitive to smothering due to increase sedimentation[77]. As discussed above, the 2014 survey work recorded the biotope assemblages in Shalfleet Creek and those present are considered to have a low sensitivity to siltation rate changes. *Hediste diversicolor* live in the sediment between depths of between 5cm and 15cm and will be well adapted to redistribution of fine sediments during the tidal cycle. A shift in the type of organisms present would be expected with longer term deposition, with a shift to higher densities of microbenthic organisms. Studies have found that mobile polychaetes, such as *Nephtys hombergii*, will burrow through thick layers of deposits to the surface. *Tubificoides* spp. and other oligochaetes live relatively deeply buried and can tolerate periods of low oxygen that may occur following the deposition of a fine layer of sediment. Studies found that *Nephtys hombergii* burrowed through ~40cm of sediment whilst *Tubificoides* spp. burrowed through ~6cm[78]. Overall resistance and resilience to increases in temporary, localised or light sedimentation are considered to be high, and therefore the biotope is not sensitive to temporary, local changes in sediment patterns. Heavy sedimentation, of approximately 30cm, is considered to have a greater	None required.	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[75] Estimated from MAGIC using the Priority Habitat Inventory – Mudflats.
[76] http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0030059.pdf
[77] M.Elliott, S.Nedwell, N.V.Jones, S.J.Read, N.D.Cutts, K.L.Hemingway (1998) Intertidal Sand and Mudflats & Subtidal Mobile Sandbanks (volume II). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project).
[78] Tillin, H.M. & Ashley, M. 2016. [*Hediste diversicolor*], [*Limecola balthica*] and [*Scrobicularia plana*] in littoral sandy mud shores. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 25-04-2019]. Available from: https://www.marlin.ac.uk/habitat/detail/331

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		PLAN NAME: Southern Water Draft Drought Plan 2022 OPTION NAME: Caul Bourne		
Potential Effects	Significance	Monitoring	Specific Mitigation	Residual Effects After Mitigation
	impact, with a medium resistance as a result of a reduction in population size. Although still a high recovery, the overall sensitivity is considered to be low. As such, the impact of the migration of the turbidity maximum is considered to be negligible. Any increase in exposure will occur at low tide only, and for the limited duration of the Drought Permit; 6 months. The frequency of the Drought Permit implementation is low; no more frequently than once in every 180-200 years. Furthermore, the WRMP19 is aiming to introduce measures on the Isle of Wight that will reduce this frequency further during the second half of the 2020s.			
Degradation of habitat – water quality	*Salinity* Mudflats and saltmarshes are reliant on a salinity regime to function and support the resultant communities. The salinity gradients zone the flora and fauna found across the saltmarshes and intertidal mudflats. Mud and sandy sediments are subject to variable salinity concentrations. The MarLIN sensitivity assessment contains evidence from relevant literature review about the sensitivity of the biotope to increases in salinity. It is considered that temporary changes in salinity would likely only affect the surface of the sediment, and not deeper buried organisms as the interstitial or burrow water is less affected. However, longer term or permanent changes in salinity would impact the sediment water. *Hediste diversicolor* has been found to be tolerant of a range of salinities from fully marine seawater down to 5PSU or less. Other species have been found to be less tolerant e.g. *Baltidrilus costata* and therefore a change in some species abundance may occur as a result of the Drought Permit moving the salinity gradient upstream. In general, recovery of *Hediste diversicolor* populations from impacts appears to be relatively rapid. Recovery will be enhanced where adult migration (active or passive) can transport adults from adjacent, unimpacted habitats. Overall the biotope is considered to be resistant to salinity changes with no significant effects to the physico—chemical character of the habitat and no long-term effect on population viability of key species. Some changes to feeding and reproduction rates, and therefore overall abundance, may be impacted during the implementation period of the Drought Permit. Resilience is considered to be high given the ability for the biotope to recover relatively rapidly. Many studies have found recovery after dredging or pipeline instalments to be within 6 months. Recovery will be enhanced where there is recolonization by larvae or adult migration from a non-impacted area. The impact of salinity changes on the mudflat habitat is therefore considered to be negligible.	None required	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
	Temperature and Oxygen During implementation of the Drought Permit, the reduced freshwater input could lead to a localised increase in temperature leading to reduced oxygen solubility. The hydrological assessment concluded that the risk of this occurring in the estuary was low, however uncertain given the lack of a clear relationship between freshwater flow input and Dissolved Oxygen saturation. As discussed in the UK Marine SACs Project literature, many intertidal species tolerate a wide change in temperatures by altering metabolic activity or mobilising to reduce the effects e.g. burrowing deeper into sediments. Severe temperature changes can result in a seasonal reduction of benthic species richness and abundance[79]. The Environment Agency review completed for the Sensitive Area and Polluted Water designations also concluded that Dissolved Oxygen was not a limiting parameter in the estuary. Therefore, although small, temporary changes could occur to the temperature and dissolved oxygen levels due to implementation of the Drought Permit, significant adverse effects on the saltmarsh and mudflat habitats are considered unlikely due to the resilience of the intertidal communities and existing Dissolved Oxygen saturation supporting a high status for fish and invertebrates (70% saturation).	None required	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
	Nutrient Dilution and Flushing As discussed in the water quality baseline conditions, nitrogen loading in the estuary is a key issue with macroalgae blooms occurring across the mudflats. This in turn can create anoxic conditions underneath reducing the diversity and abundance of the invertebrate community and potentially interfere with bird feeding patterns[80].	<u>Monitoring</u> The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and Environment Agency):	• Continued compliance with nitrogen stripping at Pennington STW. • Continued engagement in catchment management schemes	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[79] M.Elliott, S.Nedwell, N.V.Jones, S.J.Read, N.D.Cutts, K.L.Hemingway (1998) Intertidal Sand and Mudflats & Subtidal Mobile Sandbanks (volume II). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project).
[80] http://www.ukmarinesac.org.uk/pdfs/sandmud.pdf

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		PLAN NAME: Southern Water Draft Drought Plan 2022 OPTION NAME: Caul Bourne		
Potential Effects	Significance	Monitoring	Specific Mitigation	Residual Effects After Mitigation
	Impacts on water quality are assessed as of low magnitude in respect of dissolved inorganic nitrogen (DIN), dissolved oxygen concentration and soluble reactive phosphorus, although uncertain due to lack of data. The biotope complex LS.LMu.MEst is considered to be sensitive to changes in water clarity (associated with a reduction in suspended solids, impacting on resource availability for suspension feeders). The apparent tidal and marine dominance of the Newtown River estuarine system indicates that a reduction in wetted area in the upper estuary as a result of reduced freshwater inputs from the Caul Bourne would only occur at low tide. This would have a reduced impact on the limited number of subtidal benthic species (within what is likely to be an impoverished upper estuarine benthic environment) and on the very limited number of freshwater species present within Shalfleet Creek. Nitrogen loading in the estuary is a key issue with macroalgae blooms occurring across the mudflats. This in turn can create anoxic conditions underneath reducing the diversity and abundance of the invertebrate community and potentially interfere with bird feeding patterns[81]. Impacts on water quality are assessed as of low magnitude in respect of dissolved inorganic nitrogen (DIN), dissolved oxygen concentration and soluble reactive phosphorus, whilst the Drought Permit is being implemented, although uncertain due to lack of data. Water quality in Shalfleet Creek may also deteriorate during the immediate post-drought period. Following the first substantial rainfall, a rapid reversal of the groundwater drawdown (associated with the Drought Permit) could trigger a 'first-flush' pulse of accumulated nutrients in dried upper sediments to the surface waters. Such pulses, classically associated with autumn storms, may add further significance to potential ecological issues already identified in Shalfleet Creek with the implementation of the Drought Permit. While concurrent increases to surface water volume (due to rainfall/surface run off) would likely provide a degree of dilution; system feedbacks could be unpredictable. Given this uncertainty, there is therefore some risk of 'first-flush' nutrient pulses from ground water nutrient sources; however, this would be in the context of concurrent dilution from rainfall and surface run-off alongside baseline eutrophic conditions for the system. An increase in nutrient concentration as a result of an increase in flushing time, could increase the risk of opportunistic macro-algal blooms occurring in the estuary and persisting for longer as a result of the lag time for the recovery of the groundwater aquifer, and 'first-flush' effects. Literature review compiled for the MarLIN sensitivity assessment shows decreases and increases in different species. *Hediste diversicolor* may change its feeding preferences from column suspension feeder to surface deposit feeder, thereby increasing in numbers as a result of the blooms. However, other species including mud shrimp *Corophium volutator* and *Limecola balthica* showed decreases. Persistence of the blooms could lead to deoxygenation of the water and substrate. The littoral muds are generally characterised by low oxygen levels and *Hediste diversicolor* and *Tubificoides benedii* are tolerant of prolonged (~20 days, experimental evidence) hypoxia. However, enchytraeid and naidid species are more sensitive. The MarLIN sensitivity assessment documents the high resistance of the characterising species to changes in temperature and dissolved oxygen concentrations. Burying into the sediment can provide some resistance to temperature fluctuations as this buffers against temperature changes over the tidal cycle. It is considered that *Hediste diversicolor* are able to survive short term increases of temperature (a 5°C increase in temp for a one-month period) or smaller increases for a longer period (2°C for one year), against the baseline seasonal surface water temperatures of between 4 and 19°C. *Hediste diversicolor* and *Limecola balthica* are considered to have a high resistance to changes in dissolved oxygen concentration and can withstand short periods of hypoxia. However, as the biotopes are found in the intertidal zone, oxygen levels will be recharged during the tidal cycle and therefore reducing the overall risk of detrimental effects. This potential temporary change in the abundance and diversity of the mudflat invertebrate community is unlikely to cause long term changes to the structure and function to the habitat, as typical assemblages are likely to return once normal flows are reinstated after the Drought Permit. The impact is assessed as a small-moderate area over which the effect could be experienced, for a short-medium term timescale to a localised area of the upper estuary in Shalfleet Creek.	• DAIN monitoring in Shalfleet Creek. • Additional water quality monitoring for soluble reactive phosphorous (SRP), dissolved oxygen, salinity, temperature and conductivity. • Extent of algal mat cover on mudflats. • Species distribution, diversity and abundance and composition – benthic cores and biotope mapping. <u>Modelling</u> Review of effects following revised hydrology assessment using IoW model.	to reduce nitrogen loading across the catchment area. • Progression with work on phosphorous limits at Caul Bourne WTW and Shalfleet WTW, included in WINEP for delivery by 2024.	

[81] http://www.ukmarinesac.org.uk/pdfs/sandmud.pdf

Solent and Southampton Water SPA

Baseline

The Solent and Southampton Water SPA extends from Hurst Spit to Hill Head along the south coast of Hampshire, and from Yarmouth to Whitecliff Bay along the north coast of the Isle of Wight. The site includes the Newtown estuary where the mudflat habitat (as described above for the SAC) support beds of *Enteromorpha* spp. (green seaweeds) and *Zostera* spp. (seagrass) and a rich invertebrate fauna that forms the food resource for the SPA designated estuarine birds.

Details regarding the baseline of the SPA have already been provided in Section 6.4.3 above, and therefore the information is not repeated in this section.

Assessment

The Drought Permit may lead to some minor alterations to the benthic invertebrate community structure and the type of prey available to wading birds in the upper section of the estuary. The main concern in this context will be a change in the saline gradient and a slight increase in the estuary flushing time, with reduced dilution of nutrients (nitrogen). Work completed for the UK Marine SACs Project concluded that although changes in salinity may affect the prey structure, it would not necessarily affect their functioning. For example, on mud flats *Nereis* may be replaced by *Nephtys* following an increase in salinity with reduced river flows. Although the species composition is seen to have changed along the environmental gradient, the community still functions as prey for the birds. However, given the nitrate vulnerable designation (eutrophic) of the estuary, there is a low risk of an increase in algal blooms and a change phytoplankton and zooplankton community structures. This may impact the abundance and type of prey available, therefore potentially interfering with bird feeding patterns[82].

With regard to the Favourable Condition Tables, the targets that could be impacted by the Drought Permit are considered to be:

- **Annex I species: Saltmarsh – Food availability (prey species)** - Mediterranean gulls in particular forage in saltmarsh areas for small fish, and invertebrates such as worms, snails, and insects.
- **Annex I species: Intertidal mudflats and sandflats – Food availability (prey species)** - Mediterranean gulls in particular forage over mudflat and sandflat areas for small fish, and invertebrates such as worms, snails and crustaceans.
- **Waterfowl assemblage: Saltmarsh – Food availability (prey species)** - *Aster trifolium*, *Spergularia*, *Puccinellia*, *Triglochin*, *Plantago*, and *Salicornia* spp. are important food plants for dark-bellied brent geese. Soft-leaved and seed-bearing plants such as *Salicornia* spp. and Atriplex are important food plants for teal. A number of overwintering and passage birds feed on invertebrates and small fish within the saltmarsh communities.
- **Waterfowl assemblage: Intertidal mudflats and saltmarsh – Food availability (prey species)** - Most of the waders and waterfowl within the assemblage, including the internationally important regularly occurring migratory birds feed on invertebrates within and on the sediments. Black-tailed godwit for example, feed primarily on bivalve molluscs such as *Macoma*, *Cardium* and annelid worms such as *Nereis* whereas small isopods such as *Gammarus* and *Tubifex* worms are important prey species for ringed plover. Wigeon and brent geese however graze on green algae (*Enteromorpha*

[82] http://www.ukmarinesac.org.uk/pdfs/sandmud.pdf

and *Ulva* spp.), the latter preferring eelgrass (*Zostera* spp.) which grows on the sediment.

Consideration has been given to each of the qualifying species and is detailed in **Tables 6.15** and **Table 6.16** below.

Table 6.15 Potential effects on breeding Mediterranean gull

DESIGNATED SITE: Solent and Southampton Water SPA REF: UK9011061		PLAN NAME: Southern Water Draft Drought Plan 2022 OPTION NAME: Caul Bourne	
Potential Effect	Significance	Specific Mitigation	Residual Effect after Mitigation
Changes in prey abundance and prey species dominance as a result of reductions in freshwater flow inputs to the estuary (habitat degradation).	International Union of Conservation for Nature (IUCN) data indicate that the diet of Mediterranean gull includes terrestrial and aquatic invertebrates, gastropods, fish, earthworms, berries and small rodents. While changes in estuarine conditions may result in changes to prey availability and dominance it is considered unlikely that such changes would significantly affect the foraging success of the breeding population of Mediterranean gulls as this species is likely to change prey preferences in accordance to availability. Therefore, the varied and opportunistic diets of these species ameliorate the impact that the Drought Permit may have on littoral mudflat macroinvertebrate species (such as annelid worms). Given the timescales proposed for the Drought Permit and the temporal extent of the effects of a reduction in freshwater input to the estuary (i.e. at low tide only), it is considered that changes in prey availability and dominance will be of minor impact magnitude, temporary and unlikely to have any significant long-term effect upon the favourable conservation status of this species.	None required	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.
Loss and/or degradation of breeding habitat	Mediterranean gull typically nests near water on flood-lands, fields and grasslands (del Hoyo *et al*. 1996[83], Snow and Perrins 1998[84]) and on wet or dry areas of islands (Snow and Perrins 1998), favouring sparse vegetation but generally avoiding barren sand (del Hoyo *et al*. 1996). Nest sites themselves tend to be formed within a shallow depression, situated on the ground in sparsely vegetated sites. While nest sites are associated with estuarine habitats present within Newtown estuary it is not considered that changes to the condition of these habitats would arise as a result of the Drought Permit sufficient to affect nest site selection of this species nor are any other physical or habitat changes considered likely to significantly affect breeding success.	None required.	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.

Table 6.16 Potential effects on SPA wintering birds

DESIGNATED SITE: Solent and Southampton Water SPA REF: UK9011061		PLAN NAME: Southern Water Draft Drought Plan 2022 OPTION NAME: Caul Bourne		
Potential Effect	Significance	Monitoring	Specific Mitigation	Residual Effect after Mitigation
Changes in prey/food resource abundance and prey species dominance as a result of reductions in freshwater flow of the estuary.	With other watercourses also providing some further freshwater inputs to the Newtown Estuary, along with the dominant tidal influence, effects of the Drought Permit on the wider Newtown estuary are assessed as negligible. The effects of the Drought Permit on the upper part of the estuary in the Shalfleet Creek area have therefore been assessed as this part of the estuary is most directly affected. ***Dark-bellied Brent goose*** WeBS data indicate that Shalfleet Creek accounts for approximately 2.9% of the total SPA population of this species. The Phase II report for the Solent Disturbance Mitigation Project[85] recognises the importance of inter-tidal and terrestrial food sources for this species as the autumn/winter season progresses, highlighting the fact that terrestrial food sources are used extensively in late winter when coastal resources are depleted. The species is known to feed on macroalgae and angiosperms associated with estuarine environments, such as eelgrass (*Z. marina*). Given the preference for macroalgae as an initial food source on arrival (easily digestible and high in protein) to regain any weight loss[86], the additional coverage or persistence of algal blooms is unlikely to impact the feeding patterns of this species. ***Teal*** WeBS data indicate that Shalfleet Creek accounts for approximately 5.0% of the total SPA population of this species. Flocks of teal gather from August onwards in Solent and Southampton, with particularly important numbers in Newtown Harbour. Teal are a generalist feeder and are known to eat a wide range of food and prey items, ranging from terrestrial and aquatic vegetation to aquatic and terrestrial invertebrates. Given the generalist nature of the feeding characteristics of teal, it is considered unlikely that the temporary, minor magnitude of effects of the proposed Drought Permit on estuarine habitat and associated food sources will not have any significant negative effect upon the foraging success of the teal population associated with Shalfleet Creek.	None required None required	• Continued compliance with nitrogen stripping at Pennington STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Progression with work on phosphorous limits at Caul Bourne WTW and Shalfleet WTW, included in WINEP for delivery by 2024. • Investigate changes in operation of Calbourne Mill to optimise flows during implementation of Drought Permit.	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.

[83] del Hoyo, J., Elliott, A., and Sargatal, J. 1996. Handbook of the Birds of the World.
[84] Snow, D.W.; Perrins, C.M. 1998. The Birds of the Western Palearctic, Volume 1: Non-Passerines.
[85] Liley, D., Stillman, R. & Fearnley, H. (2010). The Solent Disturbance and Mitigation Project Phase 2: Results of Bird Disturbance Fieldwork 2009/10. Footprint Ecology / Solent Forum
[86] English Nature (2001) Solent European Marine Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

DESIGNATED SITE: Solent and Southampton Water SPA REF: UK9011061		**PLAN NAME: Southern Water Draft Drought Plan 2022 OPTION NAME: Caul Bourne**		
Potential Effect	Significance	Monitoring	Specific Mitigation	Residual Effect after Mitigation
	Ringed plover WeBS data indicate no presence in Shalfleet Creek of this species, although it is present in very low numbers in the Newtown Estuary. Shalfleet Creek is considered to be of low value to foraging ringed plover due to the negligible numbers of this species recorded during monitoring periods associated with the Solent Disturbance and Mitigation Project: Phase 1 Report and during low tide WeBS count surveys. This species is omnivorous and not exclusively estuarine, preying upon insects such as flies and spiders, alongside estuarine invertebrates such as polychaete worms, Crustacea and molluscs. However, being a wading bird, it is likely to be more sensitive to changes in prey abundance and composition potentially caused by the Drought Permit. The more sheltered inner reaches of the estuary (including in Shalfleet Creek) are likely to provide a favourable habitat for these wading birds. The exact number of individuals that might be expected to overwinter in the Newtown estuary is unknown. Given the potential for some adverse effects on the littoral mudflats of the more sheltered upper estuary in Shalfleet Creek due to the Drought Permit, and the unknown number of birds using Shalfleet Creek, the impact is assessed as uncertain.	• Wintering bird surveys to determine use of Shalfleet Creek by ringed plover. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in Shalfleet Creek. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
	Black-tailed godwit WeBS data indicate that Shalfleet Creek accounts for approximately 0.97% of the total SPA population of this species. The omnivorous diet of this species mainly includes infaunal polychaete worms and snails, but also includes some plants, beetles, grasshoppers and other small insects during the breeding season. *Hediste diversicolor* are an important prey item for black tailed godwits and infaunal bivalve molluscs, such as cockles (*Cerastoderma edule*) and Baltic tellin (*Macoma baltica*) are also favoured, however it is not considered exclusively estuarine. Being a wading bird, it is likely to be more sensitive to changes in prey abundance and composition potentially caused by the Drought Permit. The more sheltered inner reaches of the estuary (including in Shalfleet Creek) are likely to provide a favourable habitat for these wading birds. Flocks gather from mid-July to feed on the intertidal mudflats[87] and therefore an increase in extent of algal blooms, or increased persistence into the autumn changing the benthic invertebrate communities could result in a change in the feeding patterns of black-tailed godwit. However, it is noted that the low numbers of black-tailed godwit recorded within Shalfleet Creek suggest this part of the estuary system is of limited value for foraging purposes for this species. It is therefore considered highly unlikely that the temporary and localised changes in prey community composition in Shalfleet Creek will significantly affect the foraging success of this species.	• Wintering bird surveys to confirm numbers of black-tailed godwit using Shalfleet Creek • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in Shalfleet Creek. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
	Bird Assemblage WeBS data indicate that Newtown Harbour (estuary) supports approximately 10.3% of the total assemblage associated with the SPA (based on the published JNCC count data). Wading birds attracted to Shalfleet Creek at low water are likely to include significant numbers of redshank, whilst shelduck, dunlin, grey plover and curlew are also known to feed on the intertidal mudflats[88][89]. Although total and peak count information provided by WeBS indicates that Shalfleet Creek is generally of low value to the overwintering bird assemblage associated with the SPA, an increase in extent of algal blooms, or increased persistence into the autumn changing the benthic invertebrate communities could result in a change in the feeding patterns for these species.	• Wintering bird surveys to confirm numbers of redshank, shelduck and dunlin using Shalfleet Creek. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and		

[87] English Nature (2001) Solent European Marine Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.
[88] Environment Agency Hampshire and Isle of Wight Area (April 2005) Review of Consents Stage 3 Appropriate Assessment. Solent and Southampton Water SPA. Final version.
[89] Natural England advised that grey plover and curlew also use the mudflats in advice provided in February 2019.

DESIGNATED SITE: Solent and Southampton Water SPA REF: UK9011061		PLAN NAME: Southern Water Draft Drought Plan 2022 OPTION NAME: Caul Bourne		
Potential Effect	Significance	Monitoring	Specific Mitigation	Residual Effect after Mitigation
		condition of the mudflat habitat communities present in Shalfleet Creek. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
Habitat degradation – loss of roosting sites	***Dark-bellied Brent Goose*** The Phase II report indicated that the loss of terrestrial habitat typically has the highest effect on survival and therefore such habitat is considered to be particularly important for this species. The Drought Permit will not have any adverse effects on terrestrial habitat and therefore no impacts on roosting sites. ***Teal*** Non-breeding Teal favour areas of shallow water on estuarine coastal lagoons, coastal and inland marshes, and flooded pastures and ponds. The potential area of mudflats and saltmarsh that the Drought Permit could impact is considered to be small, with alternative habitat available for roosting. ***Ringed Plover and Bar tailed Godwit*** Both species are known to roost in saltmarsh habitat. However, this is typically in the upper marsh, where sward height is of particular importance. As the Drought Permit will not affect the upper marsh areas, there will be no adverse effects to the availability of roost sites for these species.	None required	None required	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.

Solent and Southampton Water Ramsar site

Baseline

Qualifying features and baseline conditions of the Ramsar site relevant to this Appropriate Assessment have been presented earlier in Section 6.4.6 and are not repeated here.

Assessment

The potential impacts upon the relevant criterion 1 and 2 features of the Ramsar site present in the Newtown Estuary are not considered to significantly alter from those described for qualifying features of the SAC and SPA as described in Section 6.4.3.

The potential impacts upon wintering bird species and assemblages of the Ramsar site are discussed above under the Solent and Southampton Water SPA assessment. The potential effects on the criterion 5 and 6 bird species are not considered to significantly alter from those described for qualifying features of the SPA in Section 6.4.3.

Table 6.17 assesses those species that are not covered by the SAC or SPA designations.

Table 6.17 Potential Impact on Ramsar Criteria (not covered by SAC or SPA designations)

Potential Effect	Significance	Monitoring	Specific Mitigation	Residual Effect after Mitigation
Changes in abundance and distribution as a result of reductions in freshwater flow of the estuary.	Important assemblage of rare plants and invertebrates. At least 33 BRDB invertebrates and at least eight BRDB Book plants are represented on site. Invertebrates: • *Allomelita pellucida, Gammarus insensibilis Nematostella vectensis, Arctosa fulvolineata, Aulonia albimana, Anthonomus rufus, Baris analis, Cantharis fusca, Drypta dentata, Leptura fulva, Meligethes bidentatus, Staphylinus caesareus, Aphrosylus mitis, Dorycera graminum, Haematopoda grandis, Hippobosca equina, Linnaemya comta, Stratiomys longicornis, Syntormon mikii, Tetanocera freyi, Villa circumdata, Trachysphaera lobata, Paludinella littorina, Truncatellina cylindrica, Andrena alfkenella, Elachista littoricola, Melissoblaptes zelleri, Platytes alpinella, Psamathrocrita argentella, Armandia cirrhosa.* Unlikely to be impacted by the Drought Permit as typically associated with marine habitat but presence in Shalfleet Creek needs to be confirmed through survey.	Invertebrate surveys at sampling points in Shalfleet Creek to confirm presence, distribution and abundance.	• Continued compliance with nitrogen stripping at Pennington STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Progression with work on phosphorous limits at Caul Bourne WTW and Shalfleet WTW, included in WINEP for delivery by 2024.	No adverse effect to the Ramsar site integrity, and the ability to meet the favourable conservation status will not be impeded.
	• *Anisodactylus poeciloides, Berosus spinosus, Paracymus aeneus, Atylotus latistriatus, Acleris lorguiniana* Potential to be impacted by the Drought Permit as species are associated with saltmarsh but presence in Shalfleet Creek needs to be confirmed through survey.	Invertebrate surveys at sampling points in Shalfleet Creek to confirm presence, distribution and abundance.		
	Plants: *Eleocharis parvula, Geranium purpureum forsteri, Lotus angustissimus, Ludwigia palustris, Orobanche purpurea, Lamprothamnium papulosum, Spartina maritima Zostera marina* A number of these species are unlikely to be found in the mudflat and saltmarsh habitats that could be impacted by the Drought permit; *Geranium purpureum forsteri* (rocky habitat), *Lotus angustissimus* (sea cliffs), *Orobanche purpurea* (grassland) and *Lamprothamnium papulosum* (coastal waters). *Eleocharis parvula, Ludwigia palustris*, *Spartina maritima* and *Zostera marina* could be impacted by the Drought Permit. Survey work completed in 2013 did not record these species as being present in Shalfleet Creek, however update surveys should be completed to confirm absence within the zone of influence of the Drought Permit i.e. downstream to Shalfleet Quay.	Vegetation surveys in Shalfleet Creek to confirm presence.		
Changes in abundance and distribution as a result of reductions in freshwater flow of the estuary.	Little egret (peak count spring/autumn) The coastal diet of this species is identical to other heron species and includes fish fry, crustaceans and amphibians. As the species is not reliant on mudflat benthic invertebrates, there will be no adverse effect on the foraging success of the population.	None required	As above	No adverse effect to the Ramsar site integrity and the ability to meet the favourable conservation status will not be impeded.
	Spotted and common redshank (peak count spring/autumn and winter respectively) Wading birds attracted to Shalfleet Creek at low water are likely to include significant numbers of redshank and are known to feed on the intertidal mudflats[90]. Although total and peak count information provided by WeBS indicates that Shalfleet Creek is generally of low value to the overwintering bird assemblage associated with the Ramsar, with no spotted redshank recorded, an increase in extent of algal blooms, or increased persistence into the autumn changing the benthic invertebrate communities could result in a change in the feeding patterns for these species.	• Bird surveys to confirm numbers of redshank, species using Shalfleet Creek. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in Shalfleet Creek. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
	Water rail (peak count in winter) This species will not be affected by changes in invertebrate communities on the mudflats as it is an inhabitant of wetlands	None required.		

[90] Environment Agency Hampshire and Isle of Wight Area (April 2005) Review of Consents Stage 3 Appropriate Assessment. Solent and Southampton Water SPA. Final version.

Monitoring and Mitigation

As set out above, there are a number of specific monitoring and mitigation measures that need to be implemented.

Details of the proposed baseline survey work were issued to Natural England in February 2019 for agreement, with some work having already been completed during winter 2018-2019 within the optimal survey window (wintering bird surveys). The outline for the mitigation package has been agreed, but discussions are ongoing to establish the specific elements, and will be informed by the outstanding baseline survey results. Baseline monitoring is continuing in 2021 and 2022, throughout this period information will be shared with Natural England to help develop mitigation packages.

This proposition takes account of the frequency of Drought Permit implementation (as opposed to application, which could be more frequent) of the Caul Bourne Drought Permit, which (subject to final confirmation) would be no more frequently than **once in every 180-200 years**. In addition, the WRMP19 measures for the Isle of Wight aim to reduce this frequency still further during the second half of the 2020s.

In addition, a groundwater model is being developed for the Isle of Wight water sources which will further improve the understanding of the potential effects of abstraction on river flows and the relative contribution of the Tertiary Deposits in drought conditions to flows to the Newtown estuary.

The accompanying Environmental Assessment Report also sets out the proposed monitoring that would be required for the European sites if the Drought Permit was implemented such that actual effects can be compared with the predicted scale of effects in this Appropriate Assessment. Monitoring would be carried out at the on-set of a drought to provide the drought conditions baseline, during Drought Permit implementation and post-Drought Permit implementation.

The Integrity Test

The integrity of the site is: "*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified*"

Overall, it is considered that there will be no adverse effects arising from the proposed Drought Permit on the conservation objectives of the qualifying features of the Solent Maritime SAC, Solent and Southampton Water SPA, or Solent and Southampton Water Ramsar site and thus **no adverse effect on site integrity is expected.**

In-combination effects

There is the potential for in-combination effects with the Caul Bourne WSW Drought Permit and/or the Eastern Yar augmentation scheme Drought Permit as discussed in Sections 6.7 to 6.8 below. No other in-combination effects with other activities, plans or programmes have been identified.

Conclusions

Based on current level of information regarding the proposed Drought Permit, the assessed impacts upon qualifying features of designated sites and the specific mitigation measures to be implemented, no further work under Regulation 63 of the Conservation of Habitats and Species Regulations 2017) is required.

It is however recognised that some further modelling work regarding groundwater and river flow impacts, along with some baseline monitoring surveys, have been recommended to further inform the impact assessment for the Drought Permit. The findings from this further work should be used to review the conclusions of this plan-level Appropriate Assessment which would need to be updated prior to any actual application for a Drought Permit with the new evidence.

6.6 Eastern Yar Augmentation Scheme Drought Permit

In order to protect public water supplies within Southern Water's Isle of Wight Water Resources Zone in the event of a future severe drought, Southern Water may need to apply to the Environment Agency for a Drought Permit to increase abstraction from the River Medina by amending the conditions of abstraction relating to the Eastern Yar Augmentation Scheme which involves the transfer of raw water from the River Medina catchment to the river Eastern Yar for subsequent abstraction downstream. **Table 6.18** summarises the key components of the Eastern Yar Augmentation Scheme Drought Permit - further details are set out in the draft Drought Plan and accompanying Environmental Assessment Report for this Drought Permit.

The scope of the Appropriate Assessment of the effects of the Drought Permit on European sites has been developed from the conclusions of the HRA screening assessment (as reported in Sections 4 and 5 above). A summary of the qualifying features screened in for the Appropriate Assessment is provided in **Table 6.18**, i.e. those qualifying features sensitive to the effects of the Drought Permit where the HRA screening assessment was unable to confirm there would be no likely significant effects on site integrity.

Table 6.18 Summary of proposed Eastern Yar Augmentation Scheme Drought Permit and Appropriate Assessment scope

Eastern Yar Augmentation Scheme Drought Permit	
Drought Permit details	The Drought Permit would authorise Southern Water to increase abstraction from the River Medina by reducing the Minimum Residual Flow conditions on the river as follows: • River Medina at Blackwater: reduce from 2.7Ml/d to 1.7 Ml/d • River Medina at Shide: reduce from 5 Ml/d to 4 Ml/d This will allow increased abstraction from the River Medina by Southern Water for transfer and augmentation of flows in the River Eastern Yar for subsequent re-abstraction downstream near Sandown.
European sites screened in for Appropriate Assessment	Solent Maritime SAC Solent and Southampton Water SPA Solent and Southampton Water Ramsar site
Qualifying features screened in for Appropriate Assessment	Solent Maritime SAC 1130 Estuaries 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1140 Mudflats and sandflats not covered by seawater at low tide Solent and Southampton Water SPA Article 4.1: During the breeding season - Mediterranean gull *Larus melanocephalus* (nesting & feeding) Article 4.2: Over winter: • Black-tailed godwit *Limosa islandica* (feeding) • Dark-bellied Brent goose *Branta bernicla* (roosting & feeding)

Eastern Yar Augmentation Scheme Drought Permit	
	• Ringed plover *Charadrius hiaticula* (feeding) • Teal *Anas crecca* (roosting & feeding) Assemblage qualification: A wetland of international importance. • Teal • Ringed plover • Black-tailed godwit • Little grebe *Tachybaptus ruficollis* • Wigeon *Anas penelope* • Redshank *Tringa totanus* • Pintail *Anas acuta* • Shoveler *Anas clypeata* • Grey plover *Pluvialis squatarola* • Dunlin *Calidris alpina* • Curlew *Numenius arquata* • Shelduck *Tadorna* Solent and Southampton Water Ramsar site Ramsar criterion 1: • saltmarshes • estuaries • intertidal flats Ramsar criterion 2: The site supports an important assemblage of rare plants and invertebrates. At least 33 British Red Data Book invertebrates and at least eight British Red Data Book plants are represented within the site. Qualifying bird species: ringed plover (peak counts in spring/autumn) and dark-bellied Brent goose, Eurasian teal, black-tailed godwit (peak counts in winter). Ramsar criterion 5: In addition to those species listed as part of the SPA designation, and in criterion 6: Little egret *Egretta garzetta*, spotted redshank *Tringa erythropus*, common redshank and water rail *Rallus aquaticus*. Assemblages of international importance: Species with peak counts in winter: 51343 waterfowl. Ramsar criterion 6: Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: • Ringed plover, Europe/Northwest Africa 397 individuals, representing an average of 1.2% of the GB population Species with peak counts in winter: • Dark-bellied Brent goose, 6456 individuals, representing an average of 3% of the population • Eurasian teal, NW Europe 5514 individuals, representing an average of 1.3% of the population • Black-tailed godwit, Iceland/W Europe 1240 individuals, representing an average of 3.5% of the population

Conservation objectives and Site Improvement Plan measures

Broad conservation objectives have been set for the Solent Maritime SAC and Solent and Southampton Water SPA, which are therefore of relevance to the Medina estuary:

> "*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*."

Supplementary Advice on the conservation objectives was published in March 2019 and this has been used in the assessment, and reference has also been made to the original Regulation 33 advice available for the European Marine Site[91].

Site Improvement Plans (SIPs) have also been developed for each Bern Convention Emerald Network site in England. The plans provide a high level overview of the issues (both current and predicted) affecting the condition of the features on the site(s) and outline the priority measures required to improve the condition of the features. It does not cover issues where remedial actions are already in place or ongoing management activities which are required for maintenance. A total of 17 issues have been prioritised for the Solent Maritime SAC[92] (and also for the Solent and Southampton Water SPA). The prioritised issues and affected features that may be relevant to the assessment of the proposed Caul Bourne Drought Permit are as follows (edited to relate to measures for habitats and species known to be present or potentially present in the Medina estuary only):

- **Water pollution** should not impact the following species or habitats: A026(NB) little egret, A046a(NB) dark-bellied Brent goose, A048(NB) common shelduck, A050(NB) wigeon, A052(NB) Eurasian teal, A054(NB) pintail, A056(NB) shoveler, A069(NB) red-breasted merganser, A137(NB) ringed plover, A141(NB) grey plover, A144(NB) sanderling, A149(NB) dunlin, A156(NB) black-tailed godwit, A157(NB) bar-tailed godwit, A160(NB) curlew, A162(NB) common redshank, A169(NB) turnstone, A176(B) Mediterranean gull, A191(B) sandwich tern, A192(B) roseate tern, A193(B) common tern, A195(B) little tern, H1310 glasswort and other annuals colonising mud and sand, H1320 cord-grass swards, H1330 Atlantic salt meadows and the water bird assemblage.
- **Hydrological changes** should not impact on: H1150 coastal lagoons, H1320 cord-grass swards, H1330 Atlantic salt meadows.

[91] Solent European Marine Site comprising: Solent Maritime Candidate Special Area of Conservation, Solent and Southampton Water Special Protection Area & Ramsar Site, Chichester and Langstone Harbours Special Protection Area & Ramsar Site, Portsmouth Harbour Special Protection Area & Ramsar Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994. Accessed at http://publications.naturalengland.org.uk/publication/3194402.

[92] Natural England (2014). Planning for the Future Improvement Programme for England's Natura 2000 Sites (IPENS) Site Improvement Plan: Solent. www.naturalengland.org.uk/ipens2000

- **Change to site conditions** should not impact on: A026(NB) little egret, A046a(NB) dark-bellied Brent goose, A048(NB) common shelduck, A050(NB) wigeon, A052(NB) Eurasian teal, A054(NB) pintail, A056(NB) shoveler, A069(NB) red-breasted Merganser, A137(NB) ringed Plover, A141(NB) grey plover, A144(NB) sanderling, A149(NB) dunlin, A156(NB) black-tailed godwit, A157(NB) bar-tailed godwit, A160(NB) curlew, A162(NB) common redshank, A169(NB) turnstone, A176(B) Mediterranean gull, A191(B) sandwich tern, A192(B) roseate tern, A193(B) common tern, A195(B) little tern, H1310 glasswort and other annuals colonising mud and sand, H1320 Cord-grass swards, H1330 Atlantic salt meadows and water bird assemblage.

Hydrological Assessment

Baseline

The River Medina is the main source of freshwater inflow into the Medina transitional waterbody. The tidal Medina is a coastal plain (spit enclosed) type macrotidal (range of 4.2m) estuary which covers an area of 2.19km^2 at High Water (HW) springs. The length of the estuarine reach is 7.4km and the volume of water in the estuary at high water (mean) is 10.13km^2. The tidal prism volume has been modelled, using the Analytical Emulator model[93] as 6.80km^2. The distance of saline intrusion has been estimated at ~5.3km and also modelled at 5.3km. The estimated flushing time is 8.89 days (based on a residual river flow velocity of 0.00026 m/s). The mean river inflow over one tidal cycle has been calculated as 18,000m^3 -, approximately 0.3% of the tidal prism[94]. Salinity profiles indicate a predominately well mixed estuary, with surface salinities at all times above 31ppt, and bed salinities at 34ppt to 35ppt.

The sensitivity of the estuary to surface water abstraction has been calculated in accordance with the UKTAG methodology[95] as 'Low', based on the ratio of fresh water inflow to tidal prism volume.

Assessment

As a result of the anticipated hydrological impacts between the Blackwater gauging station and Shide gauging station, the WFD transitional water body of the River Medina (The Medina Estuary) is also expected to be impacted by the drought permit.

The Lukely Brook (21.6km^2) tributary joins the River Medina downstream of Shide gauging station, however the contribution of flow from this tributary at low flows (Q_{95}) is 11 times lower than the flow in the River Medina. This flow input consequently will not materially alleviate the impacts of the upstream flow reduction. The drought permit is therefore anticipated to reduce the amount of freshwater flowing into the Medina transitional waters. The impact of abstraction from the River Medina on the estuary has been assessed based on the percentage reduction to freshwater flow expected at Reach 2 (Medina at Shide gauging station). For the transitional Medina, the impacts are therefore as follows:

- Summer: Reduction to MRF – major due to a 41% reduction in Q_{95} flow of the preceding reach to the estuarine waters.
- Winter: Reduction to MRF – major due to a 48% reduction in Q_{95} flow of the preceding reach to the estuarine waters.

[93] Manning A.J. (2012).TR167 – Enhanced UK Estuaries Database: Explanatory notes and Metadata. HR Wallingford Report DDY0427-RT002-R02-00.
[94] Ambios Environmental Consultants Ltd., 2016. Report AmbCHC02 – Sedimentary processes in the medina Estuary, May 2016. On behalf of Cowes harbour Commissioners.
[95] SNIFFER, 2008. Rapid validation of WFD83 Standards for Freshwater Flows to Estuaries.

In summary, as a result of the drought permit implementation there is a significant reduction in freshwater low flows which is assessed as a potential **major** impact on the hydrodynamics of the transitional water body. The is a precautionary assessment based on the low flow reduction of the most significant freshwater contributing river, and reflects the possibility of this reduced freshwater flow resulting in an increase to the flushing time (due to a reduced residual river flow velocity) and an alteration of the mixing characteristics (for which no data are currently available) of the upper estuary, leading to a possible increase in saline intrusion distance and migration of the turbidity maximum

Water Quality Assessment

Baseline

The Medina Estuary has been designated as a Sensitive Area (Eutrophic) and Polluted Water (Eutrophic). The evidence base for the designations included the widespread growth of macroalgae *Entermorpha* spp. and *Ulva* spp. Macroalgal surveys undertaken in 2002 and 2003 indicated that macroalgae covered 42 to 50 ha of the intertidal area. During a review completed by the Environment Agency in 2016, it was concluded that Dissolved Oxygen sags and phytoplankton blooms were not issues in the Medina Estuary, and therefore any mitigation efforts should be focussed on addressing the nutrient loading and macroalgae blooms[96]. The review also concluded that the estuary remains in a hypernutrified state.

The biggest nitrogen contribution (~68%) is from direct freshwater diffuse agricultural sources. Approximately 12% of nitrogen is from offshore coastal background sources and 11% is from indirect rivers and STW inputs via offshore. The remaining 9% is from freshwater STW, urban and intermittent inputs. Nutrient control measures have been put in place with the aim of reducing loading in the harbour.

Assessment

The reduction in flows to the Medina estuary is not considered to lead to any significant adverse effects on water quality in the estuary, with a low risk of deterioration to dissolved oxygen concentration and dissolved inorganic nitrogen (DIN). Risks to soluble reactive phosphorus (SRP) concentrations have been assessed as of medium risk based on the likely effects in the freshwater River Medina. Further details are provided in the accompanying Environmental Assessment Report.

The reduced freshwater flow input to the estuary may cause a risk of increased deposition of fine grained sediment, including the migration of the turbidity maximum due to reduced residual flow from the fluvial River Medina. However, the tidal energy and mixing will remain the dominant processes in the estuary and these processes should negate much of this risk, and it is therefore assessed as low risk.

Summary of Potential Impacts: Hydrology and Physical Environment

Table 6.19 summarises the potential effects on the physical environment due to implementation of the Drought Permit as identified in the accompanying Drought Permit Environmental Assessment Report. Additional Drought Permit abstraction from the River Medina during low river flow conditions will reduce the amount of freshwater flowing into the Medina estuary. The impact of the additional Drought Permit abstraction from the River Medina on the estuary has been assessed based on the percentage reduction to freshwater flow expected at the Shide gauging station on the River Medina:

[96] Environment Agency (2016) DATASHEET: Nitrate vulnerable zone (NVZ) designation 2017 – Eutrophic Waters (Estuaries and Coastal Waters). NVZ Name: Newtown Harbour.

- Summer Drought Permit implementation: **major** impact with a 41% reduction in Q_{95} flow to the estuarine waters.
- Winter: Reduction to MRF – **moderate** impact with a 5% reduction in Q_{95} flow to the estuarine waters but **major** impact at Q_{50} flows (48% reduction in Q_{50} flows).

This is a precautionary assessment based on the low flow reduction of the most significant freshwater contributing river, and reflects the possibility of the reduced freshwater flow resulting in an increase to the flushing time (due to a reduced residual river flow velocity) and an alteration of the mixing characteristics (for which no data are currently available) of the upper estuary, leading to a possible increase in saline intrusion distance and migration of the turbidity maximum.

Table 6.19 Summary of potential changes to the physical environment due to the proposed Eastern Yar Augmentation Scheme Drought Permit

River Medina from Shide gauging station to Medina estuary	
Major reduction of flow in the River Medina for the duration of the Drought Permit implementation in both the summer and winter Drought Permit options	• Reduction in flows of up to 41% during the summer when flows in the river are low (Q_{95} flow) • Reduction in flows of up to 5% during winter when flows in the river are low (Q_{95} flow) • Reduction in flows of up to 48% during winter when flows in the river are at Q_{50} flows
Water quality in the River Medina *Low-Medium risk during the summer/winter period*	• Low risk for Total Ammonia and dissolved oxygen and medium risk for soluble reactive phosphorus
Consented discharges *No risk during the summer/winter period*	• No consented discharges >0.5 Ml/d were identified.
Geomorphology *Medium risk during winter and summer for the duration of the Drought Permit*	• During winter and spring, there is a medium risk of changes in wetted width, and low risk of increased sedimentation and river bank collapse.
Medina estuary	
Major impacts on freshwater flows to the Medina estuary for the duration of the Drought Permit implementation in both the summer and winter options	• Reduction of freshwater flow being passed forwards from the River Medina – the dominant freshwater flow input to the estuary. 41% reduction in summer and 5% reduction in winter at Q_{95} flows (48% reduction to winter Q_{50} flows)
Water quality in Medina estuary *Low-Medium risk during the summer/winter period*	• Low risk for Dissolved Inorganic Nitrogen (DIN) and dissolved oxygen concentration; medium risk for soluble reactive phosphorus (SRP)
Consented discharges *No risk during the summer/winter period*	• No consented discharges >0.5 Ml/d identified.
Geomorphology *Low risk during winter and summer for the duration of the Drought Permit*	• During winter and spring, there is a low risk of changes in wetted width, increased sedimentation and river bank collapse.

Solent Maritime SAC

Baseline

The estuary, mudflat and sandflat and the Atlantic salt meadows habitat qualifying features have been scoped into the Appropriate Assessment in relation to the Medina estuary component of the SAC only.

H1130 Estuaries

The SAC citation describes the Medina Estuary as coastal plain estuary with mudflats ranging from low and variable salinity in the upper reaches, and only those in Chichester and Langstone Harbour being fully marine, thus suggesting a freshwater influence in the upper reaches.

The marine condition assessment has concluded that the estuaries feature is 100% unfavourable no change (18/03/2018).

The Medina estuary is a coastal plain (spit enclosed) type macrotidal (range of 4.2 m) estuary which covers an area of 2,190,000m^2 at High Water (HW) spring tide. The length of the estuarine reach is 7.4 km and the volume of water in the estuary at high water (mean) is 10,126,773m^2. The tidal prism volume has been modelled as 6,804,000 m^2. The distance of saline intrusion has been estimated at ~5.3km and the estimated flushing time is 8.890 days (based on a residual river flow velocity of 0.00026 m/s). The mean river inflow over one tidal cycle has been calculated as 18,000m^3[97], approximately 0.3% of the tidal prism. Salinity profiles indicate a predominately well mixed estuary, with surface salinities at all times above 31 ppt, and bed salinities at 34 to 35ppt. The sensitivity of the estuary to surface water abstraction has been calculated in accordance with the UKTAG methodology (see Appendix B) as 'low', based on the ratio of freshwater inflow to tidal prism volume.

Using the Supplementary Advice, it is considered that the following attributes/targets could be impacted by the drought permit, over and above the prevailing drought conditions:

- Structure: freshwater sources - Maintain the natural freshwater flow / volume into the estuary. Saltmarsh shows particular structural and plant diversity where freshwater seepages provide a transition from fresh to brackish conditions. Such areas can be important for invertebrates.
- Structure: habitat zonation - Maintain the estuary zonation, which is affected by both changes in salinity gradient and tides in the estuary from river to sea (horizontally) and with shore height (vertically) from terrestrial to subtidal.

H1330 Atlantic Salt Meadows

Atlantic salt meadows are communities of herbaceous halophytic (salt-tolerant) plants growing on the margins of tidally inundated shores. The key requirements for their development include a reasonable supply of sediment and a low energy wave environment. The other key requirements include the following[98]:

- twice-daily tidal cycles.
- sediment transport across the shore.
- sediment accumulation.
- establishment of salt tolerant plants.

The above set of requirements indicate that tidal and marine processes are the dominant processes required to sustain this habitat. Atlantic salt meadows develop when halophytic vegetation colonises soft intertidal sediments of mud and sand in areas protected from strong wave action. This vegetation forms the middle and upper reaches of saltmarsh, where tidal inundation still occurs but with decreasing frequency and duration. A wide range of community

[97] Ambios Environmental Consultants Ltd., 2016. Report AmbCHC02 – Sedimentary processes in the medina Estuary, May 2016. On behalf of Cowes Harbour Commissioners.
[98] Doody J.P. 2008. Management of Natura 2000 habitats. 1330 Atlantic salt meadows (*Glauco- Puccinellietalia maritimae*). European Commission

types is represented and the saltmarsh can cover large areas, especially where there has been little or no enclosure on the landward side.

The saltmarshes generally consist of angiosperm-dominated stands of vegetation, occurring on the extreme upper shore of sheltered coasts and periodically covered by high tides. The vegetation develops on a variety of sandy and muddy sediment types and may have admixtures of coarser material. The character of the saltmarsh communities is affected by height up the shore, resulting in a zonation pattern related to the degree or frequency of immersion in seawater. These habitats are less dependent on freshwater input and so are less sensitive to changes in freshwater input and are not likely be impacted by the reduced freshwater flows arising from the drought permit.

The Medina Estuary SSSI citation provides further background to the saltmarsh communities present. The citation states, "The numerous fragments of saltmarsh that occur along both sides of the estuary are considered relict features of more extensive marshes which originally formed when the physical character of the river was markedly different from that of today. The largest and best preserved of these is the Werrar saltmarsh which fringes the mid-western edge of the estuary. It exhibits a clear zonation of vegetation reflecting classic stages in saltmarsh development. The lower marsh is dominated by sea purslane *Halimione portulacoides* with some cord-grass *Spartina anglica.* This grades to higher, mixed marsh community with a richer flora dominated by sea lavender *Limonium vulgare*, sea plantain *Plantago maritima* and sea blite *Suaeda maritima*, with glasswort *Salicornia* species occupying low 'pans'. The highest levels of the marsh grade to sea couch-grass *Elymus pycnanthus*, commonly with sea club-rush *Scirpus maritimus*, sea aster *tripolium* and, at the margins, two nationally scarce species, divided sedge *Carex divisa* and golden samphire *Inula crithmoides*".

The low flow channel is not designated as part of the SSSI but is part of the SAC. Therefore, the SSSI unit and condition assessment is confined to the intertidal area between mean low and mean high water. Units 9 and 10 are the closest to the tidal limit upstream. Both consist of littoral sediment and are in unfavourable-no change condition as a result of nutrient source issues. The units further downstream; 1, 2, 4, 5, 6 are of the same condition for the same underlying reasons.

Priority habitat and EMODnet seabed habitat mapping of the EUNIS marine habitats records very few areas of saltmarsh in the upper estuary. The first main component is at the Fairlee sewage treatment works, and then there is an area just upstream of Island Harbour and the large area of saltmarsh at Werrar. These are located some distance downstream from the tidal limit; ~2.5km. The predominant habitat types within the estuary and littoral mud and sublittoral sediments.

<u>H1140 Mudflats and sandflats not covered by seawater at low tide</u>
Mudflats and sandflats not covered by seawater at low tide form a major component of the Newtown estuary. This habitat type can be divided into three broad categories (clean sands, muddy sands and muds), although in practice there is a continuous gradation between them. Within this range the plant and animal communities present vary according to the type of sediment, its stability and the salinity of the water.

The Medina Estuary SSSI citation states that "The invertebrate community present within the estuary is one more commonly associated with marine rather than estuarine situations and presumably reflects the relatively small freshwater volume of the Medina river".

Data regarding the benthic (intertidal) habitats within the Medina Estuary are limited and no data on the subtidal habitats have been made available. Data obtained from the European Marine Observation Data Network[99] indicates that the mudflats consists mostly of littoral mud (LS.LMu) within the estuary channel. Littoral mud habitats consist of two main biotope complexes which include polychaete/bivalve–dominated mid-estuarine mud shores (LS.LMu.MEst) and polychaete/oligochaete–dominated upper estuarine mud shores (LS.LMu.UEst). These two biotope complexes are split by position in the estuary, specifically regarding the salinity regime.

Mid-estuarine shores of fine sediment are mostly in the silt and clay fraction (particle size less than 0.063 mm in diameter), although sandy mud may contain up to 40% sand (mostly very fine and fine sand). Upper estuarine sandy mud and mud shores, in areas with significant freshwater influence, support few infaunal species and are principally characterised by a limited range of polychaetes and oligochaetes. Most mid-estuarine muddy shores are subject to some freshwater influence, although at some locations more or less fully marine conditions may prevail. Such marine conditions are most likely limited to the small inter-tidal area associated with the mouth of the estuary. Mid-estuarine muds support rich communities characterised by polychaetes, bivalves and oligochaetes[100].

The European Marine Observation Data Network indicates that the estuary is mainly dominated by sublittoral sediment. This habitat type consists of seven sub-habitats each consisting of several biotopes. Detailed information regarding the sub-habitats and biotopes present within the Medina Estuary was not available and therefore a detailed assessment could not be undertaken; however, it is likely that the sub-habits are mainly sublittoral coarse sediment, sand, mud or mixed sediments in variable salinity.

Assessment

H1130 Estuaries

Freshwater inflows at Q_{95} flows are estimated be reduced by approximately 41% as a result of the drought permit if implemented during the summer and is therefore considered to be a **major** hydrological impact. A reduction in freshwater flow fails the attribute and target to maintain natural freshwater flow / volume into the estuary.

The supplementary advice states that "*retaining natural transitions from river to sea and upper to lower shore are important to a healthy estuary structure. Habitat zonation will be representative of the limits and range of estuarine communities with tidal movements and salinity*". A reduction in freshwater inflow could lead to the lengthening of the saline portion of the estuary, with the saline gradient moving upstream. A shift in isohalines with the salinity gradient moving upstream is likely to affect any tidal freshwater marsh or saltmarsh with a freshwater reliance in the upper part of the estuary. The distribution of vegetation and sessile and benthic organisms within the saltmarsh and mudflat habitats could be altered with saline tolerant species moving further upstream. Reductions in water quality as a result of an increase in flushing time could lead to algal blooms, with localised increases in temperature as the cooling effect of the freshwater input is lost and smaller body of water heating more quickly. A reduction in water flow could lead to localised deposition of fine sediment, with the overall suspended solid load likely reduced and an upstream migration of the turbidity

[99] European Marine Observation Data Network (EMODnet) Seabed Habitats project (www.emodnet-seabedhabitats.eu), funded by the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE).
[100] Connor DW, Allen JH, Golding N, Howell KL, Lieberknecht ML, Northen KO and Reker JB (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough ISBN 1 861 07561 8 (internet version)

maximum (as the area where the salt wedge of saline intrusion meets with the fresh water influx, resulting in flocculation of suspended particulate matter).

The impact would be temporary, lasting for the duration of the drought permit and recovery of the species and habitats. Therefore a 'lasting effect,' resulting in the permanent loss of a qualifying habitat or species, or the 'long term deterioration' of the habitats or species within the estuary is considered unlikely. However, the effect of the drought permit is considered to be a large scale change (volume of freshwater) implemented over a short-medium term timescale to a localised area of the upper estuary in the Medina Estuary. Specific mitigation is detailed in the following sections for the underlying habitats, and therefore it is considered that there will be no adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded in the medium-long term.

H1330 Atlantic salt meadows

The key impact of the drought permit is to reduce the freshwater input to the transitional waterbody. The resulting effects are considered to be:

- Potential increase in exposure at low tide as a result of a reduction in wetted area and possible desiccation of communities.
- Shift in isohalines with a change in distribution of vegetation (e.g. upstream migration of *Spartina* species) and sessile and benthic organisms[101].
- Shift in saltmarsh zones with reduction in pioneer communities as a result of smothering from finer sediments deposited as a result of low flows and velocities[102].
- Changes in water chemistry parameters – temperature, dissolved oxygen and dissolved and particulate matter leading to changes in water quality.
- Increase in flushing or freshwater transit time resulting in a build-up of nutrients and pollutants, with an increased risk of algal blooms.
- Increased influence of tide on circulation patterns as a result of reduced freshwater input.

Using the Supplementary Advice, it is considered that the following attributes/targets could be impacted by the drought permit, over and above the prevailing drought conditions:

- Structure and function: vegetation structure - zonation of salt marsh vegetation: Maintain the full range of zonations (low-mid, mid, mid-upper and transitional zones) between component saltmarsh communities found in H1330 (Atlantic salt meadows).
- Supporting processes: sedimentary processes: Maintain the sedimentary processes (suspended sediment, sediment transfer, etc.) that sustain the elevation and topography of the marsh surface.
- Supporting processes: water quality: Where the feature is dependent on estuarine water, ensure water quality and quantity is restored to a standard that provides the necessary conditions to support the feature.

[101] Gilbert, S., K. Lackstrom, and D. Tufford. 2012. The Impact of Drought on Coastal Ecosystems in the Carolinas. Research Report: CISA-2012-01. Columbia, SC: Carolinas Integrated Sciences and Assessments.
[102] Tyler-Walters, H., 2001. Saltmarsh (pioneer). In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 08-03-2019]. Available from: https://www.marlin.ac.uk/habitat/detail/25

The Medina Estuary Favourable Condition Tables (2010) include the following attributes and targets that could be impacted by the drought permit, over and above the prevailing drought conditions:

- Vegetation structure: zonation of vegetation – Characteristic range of variation of typical of the site maintained, subject to natural change.
- Vegetation composition: characteristic species – Maintain frequency of characteristic species of saltmarsh zones as follows: Pioneer zone: At least one typical species frequent and another occasional; Low-mid marsh: At least one of *Puccinellia maritima*, *Atriplex portulacoides* or *Salicornia* spp. dominant, and two other typical species at least frequent; Mid-upper marsh: At least one typical species abundant and three frequent.

Table 6.20 summarises the potential effects on the Atlantic salt meadow due to implementation of the Drought Permit.

Table 6.20 Potential effects on Atlantic salt meadows habitat

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar		
Potential Effect	Significance	Monitoring	Specific Mitigation Measures	Residual Effect After Mitigation
Habitat degradation – exposure and desiccation	There are communities of herbaceous halophytic (salt-tolerant) plants growing on the margins of tidally inundated shores. The key requirements for the development of Atlantic salt meadows include: • a reasonable supply of sediment and a low energy wave environment. • twice-daily tidal cycles. • sediment transport across the shore. • sediment accumulation. • establishment of salt tolerant plants. There is a small area of Atlantic salt meadow recorded along the periphery of the Medina Estuary (9.38Ha – priority habitat mapping). While a reduction in the wetted width of the main estuary channel is considered likely as a result of the Drought Permit, it is considered unlikely that such a reduction would have any significant effect upon the habitat conditions favoured by species present within the Atlantic salt meadows, and particularly given the location of the saltmarsh towards the mid-estuary. The MarLIN sensitivity assessment looked at the sensitivity of saltmarsh to desiccation as a result of drought. The overall sensitivity is considered to be low, as a result of intermediate intolerance (some loss of species and reduction in viability of population) but a high recoverability (recovery will take many months, but less than 5 years). The majority of the saltmarsh habitat is situated above the mean low water level and the duration of the effect will be intermittent and restricted to low water, with areas submerged again at higher tides. As the impacts of a reduced wetted area are considered to be localised to the upper estuary, and the saltmarsh is located mid-estuary, the impact is considered to be low/negligible; a small scale change (wetted width), with intermittent effect over a short-medium term timescale to a very localised area of saltmarsh in the mid-estuary. The connectivity of the saltmarsh to the low flow channel, at low tide, will be confirmed through baseline survey as no data is currently available.	Habitat survey – confirm connectivity of saltmarsh to channel and risk mapping of vulnerability of saltmarsh to drought impacts	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Species loss – shift in community	*Salinity* Mudflats and saltmarshes are reliant on a salinity regime to function and support the resultant communities. The salinity gradients zone the flora and fauna found across the saltmarshes and intertidal mudflats. Salinity is also an important parameter in saltmarsh root growth including its ability to influence plant nitrogen assimilation and sediment nitrogen retention, which in turn influences the stability of the marsh[103]. The MarLIN sensitivity assessment has concluded that saltmarsh species are tolerant of a range of salinities, typically within the range of 18-40psu, although the pioneer communities are tolerant of greater salinities than the upper marshes. The habitat is considered to have a low sensitivity to changes in salinity, with intolerance being low (species unlikely to be killed, but overall viability reduced) but a very high recoverability (full recovery within a couple of weeks and less than 6 months). With a decrease in freshwater input there is the potential for the community composition to follow the salinity gradient, with more saline tolerant species replacing those requiring greater freshwater inputs in the upper estuary. The impact is therefore considered to be low/negligible; a small area over which the effect could be experienced (pioneer and lower marsh), for a short-medium term timescale to a very localised area of saltmarsh in the mid-estuary. Baseline survey work will need to be completed to confirm the connectivity of the saltmarsh to the low flow channel and its risk to the effects of the drought permit.	Habitat survey – confirm connectivity of saltmarsh to channel and risk mapping of vulnerability of saltmarsh to drought impacts	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Habitat degradation – sedimentation	The drought permit may affect the saltmarsh habitat through reduced sediment supply from the River Medina due to the reduced velocities during low flow conditions. However, during a period of drought, river levels would naturally be low and therefore the movement of sediment is likely to have already reduced significantly prior to implementation of the drought permit. In addition, the areas of saltmarsh present along the periphery of the Medina estuary do not appear to be directly connected to the channel. Impacts to the Atlantic salt meadows relating to reduced fluvial sediment supply and reduced freshwater flows to the Medina estuary (over and above those arising due to natural drought conditions) are assessed as negligible.	None required	None required.	No adverse effect to the SAC integrity and the ability to meet favourable conservation status will not be impeded.

[103] Alldred M, Liberti A and Baines S.B. (2017) Impact of salinity and nutrients on salt marsh stability. Ecosphere. Accessed at https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2010.

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar		
Potential Effect	Significance	Monitoring	Specific Mitigation Measures	Residual Effect After Mitigation
Habitat degradation – water quality	*Temperature and Oxygen* Dissolved oxygen saturation/concentration data were consistent with the standard to support high status for fish and invertebrates in the transitional water. The risk of water quality deterioration with respect to Dissolved Oxygen is therefore assessed as low. The Environment Agency review for the Sensitive Area (E) and Pollution Waters (E) designations also concluded that dissolved oxygen sags were not an issue in the estuary. Therefore, although small, temporary changes could occur to the temperature and dissolved oxygen levels due to implementation of the Drought Permit, significant adverse impacts on the saltmarsh and mudflat habitats are considered unlikely due to the resilience of the intertidal communities and existing Dissolved Oxygen saturation supporting a high status for fish and invertebrates.	None required	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
	Nutrient Dilution and Flushing As discussed in the water quality baseline conditions, nitrogen loading in the estuary is a key issue with macroalgae blooms occurring across the mudflats. This in turn can create anoxic conditions underneath reducing the diversity and abundance of the invertebrate community and potentially interfere with bird feeding patterns[104]. Saltmarsh root growth can be restricted by raised salinity and low oxygen concentrations in the soil reducing the plants ability to acquire sufficient quantities of phosphorous and nitrogen[105]. Increased nitrogen and phosphorous loading on saltmarshes can alter the species composition and accelerate the successional stages, with those plant species characteristic of more fertile sites becoming dominant and those species of less nutrient rich sites, and typical of the early successional stages, being outcompeted[106]. Nitrogen loading, and eutrophication, also reduces the growth of saltmarsh root and rhizome systems, thereby affecting the stability of the marsh[107]. The hydrological assessment concluded the risk of deterioration to Dissolved Inorganic Nitrogen (DIN) within the estuarine reach is low, however uncertain due to the lack of data. The reduced dilution of nutrients and increased flushing time may increase the area of saltmarsh covered by algal mats, and potentially cause a temporary shift in species abundance and composition in the lower marsh as a result of the change in nutrients, compounded by the change in salinity regime. The recovery time required for the groundwater aquifer to contribute baseline flows to flush through the nutrients could allow the algal blooms to persist longer into the autumn months. The amount of algal cover affecting the saltmarsh communities will need to be confirmed through baseline survey as no data is currently available.	The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and the Environment Agency): • DAIN monitoring in upper Medina Estuary (upstream of ~Wippingham). • Additional water quality monitoring for soluble reactive phosphorous (SRP), dissolved oxygen, salinity, temperature and conductivity. • Extent of algal mat cover on lower marshes. • Species abundance and composition in the lower marshes.	• Continued compliance with nitrogen stripping at Peel Common STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Consider other specific measures that can be implemented in Medina catchment to reduce nitrogen and/or phosphorous.	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Intra-permit effects	Multiple individual effects on the saltmarsh habitat have been identified as a consequence of the reduction in freshwater input to the estuary. The effects will act synergistically, on the same receptor at similar times to potentially increase the overall effect of degrading the saltmarsh habitat. However, the combined effects are not sufficient to cause a long-term change in the saltmarsh community, or affect a large extent being limited to the upper estuary. The overall viability of the saltmarsh is not considered to be adversely affected in the long-term with the impacts reversible in the short-medium term when freshwater inputs are restored. Baseline survey work will need to be completed to confirm the connectivity of the saltmarsh to the low flow channel and its risk to the effects of the drought permit.	As above	As above	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[104] http://www.ukmarinesac.org.uk/pdfs/sandmud.pdf
[105] Saltmarsh Review JNCC Report 334
[106] Van Wijnen H.J. and Bakker J.P. (1999) Nitrogen and phosphorous limitation in a coastal barrier saltmarsh: the implications for vegetation succession. Journal of Ecology.
[107] Alldred M, Liberti A and Baines S.B. (2017) Impact of salinity and nutrients on salt marsh stability. Ecosphere. Accessed at https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2010

H1140 Mudflats and sandflats not covered by seawater at low tide

The key impact of the drought permit is to reduce the freshwater input to the transitional waterbody. The resulting effects are considered to be:

- Reduction in water levels with a reduced wetted area at low tide.
- Reduction in flow, velocities and sediment input leading to potential changes in sedimentation patterns.
- Change in location of salinity/freshwater interface with potential migration upstream.
- Changes in water chemistry parameters – temperature, dissolved oxygen and dissolved and particulate matter leading to changes in water quality.
- Increase in flushing or freshwater transit time resulting in a build-up of nutrients and pollutants.
- Increased influence of tide on circulation patterns as a result of reduced freshwater input.

Using the Supplementary Advice, it is considered that the following attributes/targets could be impacted by the drought permit, over and above the prevailing drought conditions:

- Structure and function: presence and abundance of key structural and influential species – [Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.
- Supporting processes: energy / exposure – Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure [High / Medium / Low] does not cause alteration to the biotopes, and stability, across the habitat.
- Supporting processes: physico-chemical properties – Maintain the natural physico-chemical properties of the water.
- Supporting processes: water quality - dissolved oxygen – Maintain the dissolved oxygen concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.
- Supporting processes: water quality – nutrients – Restore water quality to mean winter dissolved inorganic nitrogen levels at which biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features.
- Supporting processes: water quality – turbidity – Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.

The Medina Estuary SSSI Favourable Condition Tables includes the following attributes and targets for the mudflat habitat:

- Species population measures – Population structure should be assessed in terms of viability of characteristic species identified for the site.
- Population structure should be assessed in terms of viability of characteristic species identified for the site – Maintain age/size class structure of key indicator species.

Table 6.21 summarises the potential effects on the mudflats and sandflats not covered by seawater at low tide due to implementation of the Drought Permit.

Table 6.21 Potential effect on mudflats and sandflats

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar		
Potential Effect	Significance	Monitoring	Mitigation	Residual Effect after Mitigation
Habitat degradation - exposure and desiccation	From satellite images the areas of mudflats that could be impacted by the Drought Permit are upstream of Northwood and Whippingham. Any increase in exposure will occur at low tide only, and for the limited duration of the Drought Permit; 6 months. The area of mudflats that could be subject to increased exposure is approximately 68ha[108]. This is approximately 1.3% of the total mudflats area (5,059.4ha) identified in the SAC citation[109]. The frequency of the Drought Permit implementation is low; no more frequently than once in every 180-200 years. Furthermore, the WRMP19 is aiming to introduce measures on the Isle of Wight that will reduce this frequency further during the second half of the 2020s. The lower shore normally remains saturated during low tide. With exacerbated low flow conditions due to the implementation of the Drought Permit (41% reduction in freshwater flow at Q_{95}), there is likely to be a small reduction in the wetted area of the channel in the upper Medina Estuary at low tide. This could lead to a greater area of mudflats becoming drained, and the sediment becoming firm and compacted, with a smaller saturated zone. Many of the species of the mudflats live in burrows and are capable of retreating into these burrows during periods of exposure, and thereby providing protection from desiccation. *Hediste diversicolor* inhabits a burrow approximately 0.3m deep and *Tubificoides benedii* is capable of burrowing to depths of approximately 10cm. Abundance of the latter is suggested to be driven by a decrease in high water level or an increase in the length of time the substrate is not covered by water. Increased emergence has been found to cause a decline in abundance of *Hediste diversicolor* at the upper limits of the intertidal zone, as a result of substrate drying and greater extremes of temperature. However, *Hediste diversicolor* are mobile enough to migrate to damper substrates. An increase in emergence as a result of the drought permit during low flows at low tide could decrease the upper shore extent of *Hediste diversicolor*. However, the biotope overall is considered to have a high resistance and high resilience, and therefore is not considered to be sensitive to changes in emergence. The structure of the mudflats is unlikely to change because of the temporary increased exposure; however, the sedentary benthic invertebrate communities could be at risk of increased desiccation. This could lead to a localised, temporary change in the species distribution, diversity and abundance of the mudflats.	The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and Environment Agency): • Flow, velocity and wetted area measurements within the Medina estuary. • Walkover survey of Medina Estuary to assess the level of low tide hydrological features and connectivity with the habitats (mudflats/sandflats). • Habitat mapping of mudflats and connectivity with channel at low tide.	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
Habitat degradation – sedimentation	Studies[110] on behalf of the Cowes Harbour Commissioners have collated extensive data on the sedimentary composition of the Medina estuary. The bed substrate within the upper section of the estuary, within the channel, is predominately silt dominated mud (with a low fraction of clay and minor sand/gravel components). This transitions to a clay dominated substrate forming mudflats along the banks. Due to the fine grained lithologies within the catchment, clay could make a significant portion of the suspended sediment, especially due to the tidal location of the reach. A significant area of gravel (mostly biogenic in origin, comprised of *Ostrea edulis* shell) exists within the channel in upper section of the estuary. In the upper estuary there may be increased sedimentation of sand and silt grades. These changes in sediment size and mobility may change species numbers and richness, although mudflat species have a greater tolerance for different particle sizes and a high bioturbatory therefore being less sensitive to smothering due to increase sedimentation[111]. Overall resistance and resilience to increases in temporary, localised or light sedimentation are considered to be high, and therefore the biotope is not sensitive to temporary, local changes in sediment patterns. Heavy sedimentation, of approximately 30cm, is considered to have a greater impact, with a medium resistance as a result of a reduction in population size. Although still a high recovery, the overall sensitivity is considered to be low. As such, the impact of the migration of the turbidity maximum is considered to be **negligible.**	None required	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[108] Estimated from MAGIC using the Priority Habitat Inventory – Mudflats.
[109] http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0030059.pdf
[110] Ambios Environmental Consultants Ltd., 2016. Report AmbCHC02 – Sedimentary processes in the medina Estuary, May 2016. On behalf of Cowes harbour Commissioners
[111] M.Elliott, S.Nedwell, N.V.Jones, S.J.Read, N.D.Cutts, K.L.Hemingway (1998) Intertidal Sand and Mudflats & Subtidal Mobile Sandbanks (volume II). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project).

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar		
Potential Effect	Significance	Monitoring	Mitigation	Residual Effect after Mitigation
Habitat degradation – water quality	*Salinity* Mud and sandy sediments are subject to variable salinity concentrations. The MarLIN sensitivity assessment contains evidence from relevant literature review about the sensitivity of the biotope to increases in salinity. It is considered that temporary changes in salinity would likely only affect the surface of the sediment, and not deeper buried organisms as the interstitial or burrow water is less affected. However, longer term or permanent changes in salinity would impact the sediment water. *Hediste diversicolor* has been found to be tolerant of a range of salinities from fully marine seawater down to 5PSU or less. Other species have been found to be less tolerant e.g. *Baltidrilus costata* and therefore a change in some species abundance may occur as a result of the drought permit moving the salinity gradient upstream. In general, recovery of *Hediste diversicolor* populations from impacts appears to be relatively rapid. Recovery will be enhanced where adult migration (active or passive) can transport adults from adjacent, unimpacted habitats. Overall the biotope is considered to be resistant to salinity changes with no significant effects to the physico—chemical character of the habitat and no long-term effect on population viability of key species. Some changes to feeding and reproduction rates, and therefore overall abundance, may be impacted during the implementation period of the drought permit. Resilience is considered to be high given the ability for the biotope to recover relatively rapidly. Many studies have found recovery after dredging or pipeline instalments to be within 6 months. Recovery will be enhanced where there is recolonization by larvae or adult migration from a non-impacted area. The impact of salinity changes on the mudflat habitat is therefore considered to be negligible.	None required.	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
	Temperature and Oxygen Dissolved oxygen saturation/concentration data were consistent with the standard to support high status for fish and invertebrates in the transitional water. The risk of water quality deterioration with respect to Dissolved Oxygen is therefore assessed as low. As discussed in the UK Marine SACs Project literature, many intertidal species tolerate a wide change in temperatures by altering metabolic activity or mobilising to reduce the effects e.g. burrowing deeper into sediments. Severe temperature changes can result in a seasonal reduction of benthic species richness and abundance[112]. Therefore, although small, temporary changes could occur to the temperature and dissolved oxygen levels due to implementation of the Drought Permit, significant adverse impacts on the saltmarsh and mudflat habitats are considered unlikely due to the resilience of the intertidal communities and existing Dissolved Oxygen saturation supporting a high status for fish and invertebrates.	None required.	None required	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
	Nutrient Dilution and Flushing As discussed in the water quality baseline conditions, nitrogen loading in the estuary is a key issue with macroalgae blooms occurring across the mudflats. This in turn can create anoxic conditions underneath reducing the diversity and abundance of the invertebrate community and potentially interfere with bird feeding patterns[113]. Water quality risks have been assessed as low (for DIN and dissolved oxygen) and medium for SRP. Reduced SRP water quality conditions may increase the risk of algal blooms and changes in the phytoplankton community in the estuary but the magnitude of this impact is assessed as low, reflecting the baseline position of mats of green algae, mainly *Enteromorpha* species and *Ulva lactuca*, that form during late spring and summer under 'normal' conditions. Literature review compiled for the MarLIN sensitivity assessment shows decreases and increases in different species. *Hediste diversicolor* may change its feeding preferences from column suspension feeder to surface deposit feeder, thereby increasing in numbers as a result of the blooms. However, other species including mud shrimp *Corophium volutator* and *Limecola balthica* showed decreases. Persistence of the blooms could lead to deoxygenation of the water and substrate. The littoral muds are generally characterised by low oxygen levels and *Hediste diversicolor* and *Tubificoides benedii* are tolerant of prolonged (~20 days, experimental evidence) hypoxia. However, enchytraeid and naidid species are more sensitive.	The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and Environment Agency): • DAIN monitoring in upper Medina Estuary (upstream of ~Wippingham). • Additional water quality monitoring for soluble reactive phosphorous (SRP), dissolved oxygen, salinity, temperature and conductivity.	• Continued compliance with nitrogen stripping at Peel Common STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Consider specific measures that can be implemented in Medina catchment to reduce nitrogen and/or phosphorous.	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[112] M.Elliott, S.Nedwell, N.V.Jones, S.J.Read, N.D.Cutts, K.L.Hemingway (1998) Intertidal Sand and Mudflats & Subtidal Mobile Sandbanks (volume II). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project).
[113] http://www.ukmarinesac.org.uk/pdfs/sandmud.pdf

DESIGNATED SITE: Solent Maritime SAC REF: UK0030059		**PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar**		
Potential Effect	Significance	Monitoring	Mitigation	Residual Effect after Mitigation
	The MarLIN sensitivity assessment documents the high resistance of the characterising species to changes in temperature and dissolved oxygen concentrations. Burying into the sediment can provide some resistance to temperature fluctuations as this buffers against temperature changes over the tidal cycle. It is considered that *Hediste diversicolor* are able to survive short term increases of temperature (a 5°C increase in temp for one month period) or smaller increases for a longer period (2°C for one year), against the baseline seasonal surface water temperatures of between 4 and 19°C. *Hediste diversicolor* and *Limecola balthica* are considered to have a high resistance to changes in dissolved oxygen concentration and can withstand short periods of hypoxia. However, as the biotopes are found in the intertidal zone, oxygen levels will be recharged during the tidal cycle and therefore reducing the overall risk of detrimental effects. This potential temporary change in the abundance and diversity of the mudflat invertebrate community is unlikely to cause long term changes to the structure and function to the habitat, as typical assemblages are likely to return once normal flows are reinstated after the Drought Permit. The impact is assessed as affecting a small-moderate area for a short-medium term timescale to a localised area of the upper estuary of the Medina Estuary,			

Solent and Southampton Water SPA

Baseline

The Solent and Southampton Water SPA extends from Hurst Spit to Hill Head along the south coast of Hampshire, and from Yarmouth to Whitecliff Bay along the north coast of the Isle of Wight. The site includes the Medina estuary where the mudflat habitat (as described above for the SAC) support beds of *Enteromorpha* spp. (green seaweeds) and *Zostera* spp. (seagrass) and a rich invertebrate fauna that forms the food resource for the SPA designated estuarine birds.

The SPA qualifies under Articles 4.1 and 4.2 of the Birds Directive by supporting populations of a number of breeding species under Annex I of the directive and supporting populations of European importance of the migratory species (see **Table 6.13**). The site also qualifies under Article 4.2 of the Birds Directive by regularly supporting at least 20,000 waterfowl.

In relation to the Medina estuary component of the SPA, the following SPA designated bird species are likely to be present.

Breeding birds

Mediterranean gull – **Table 6.22** shows that the entirety of the Medina estuary population of Mediterranean gull was recorded by WeBS in the mid part of the estuary (WeBS sector code DE002). No specific recent data on breeding Mediterranean gull have been identified but a precautionary approach has been adopted for this Appropriate Assessment by assuming breeding as well as feeding and over-wintering may take place within the Medina estuary.

Table 6.22 WeBS count data for Mediterranean gull in the Medina estuary

Medina Estuary: Mediterranean gull count data (sector code DE001, DE002 and DE003)					
Counts	**November**	**December**	**January**	**February**	**Total**
Individual counts: Medina estuary	-	-	-	2	**2**
Total (peak) count for Medina estuary (sector code DE001)					**0**
% present for DE001 population					**0%**
Total (peak) count for Medina estuary (sector code DE002)					**2**
% present for DE002 population					**100%**
Total (peak) count for Medina estuary (sector code DE003)					**0**
% present for DE003 population					**0%**

Wintering birds

Information presented within the Solent Disturbance and Mitigation Project: Phase 1 report[114] summarises Wetland Birds Survey (WeBS) data for the qualifying SPA bird species screened into the Appropriate Assessment. WeBS data were also obtained for the Medina estuary as discussed below.

Ringed plover – the Solent Disturbance and Mitigation Project: Phase 1 report indicates that Ringed plover were distributed widely across the SPA with significant flocks recorded along

[114] Stillman, R. A., Cox, J., Liley, D., Ravenscroft, N., Sharp, J. & Wells, M. (2009) Solent Disturbance and Mitigation Project: Phase I report. Report to the Solent Forum

the north east coast of the Isle of Wight. However, low numbers of birds (5-6 individual birds) only have been recorded within upper Medina estuary margins (**Table 6.23**).

Table 6.23 Ringed plover: WeBS wintering bird data for Medina estuary

Medina estuary (sector codes DE001, DE002 and DE003): Ringed plover count data					
Counts	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	-	1	-	-	**1**
Total (peak) count for Medina estuary (sector code DE001)					**0**
% present for DE001 population					**0%**
Total (peak) count for Medina estuary (sector code DE002)					**1**
% present for DE002 population					**100%**
Total (peak) count for Medina estuary (sector code DE003)					**0**
% present for DE003 population					**0%**
% of SPA population					**0.18%**

Black-tailed godwit – The Solent Disturbance and Mitigation Project: Phase 1 report indicates Chichester and Langstone Harbour are the main sites of significant value to black-tailed godwit with average peak counts of 1207 birds (8 times the national threshold for this species). By comparison, low numbers of black-tailed godwit (maximum of 3 birds) were recorded within upper Medina estuary margins. WeBS low tide count data are shown in **Table 6.24**.

Table 6.24 Black-tailed godwit: WeBS wintering bird data for Medina estuary

Medina estuary (sector codes DE001, DE002 and DE003): Black-tailed godwit count data					
Counts	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	33	19	19	3	**74**
Total (peak) count for Medina estuary (sector code DE001)					**7**
% present for DE001 population					**9.45%**
Total (peak) count for Medina estuary (sector code DE002)					**23**
% present for DE002 population					**31.08%**
Total (peak) count for Medina estuary (sector code DE003)					**19**
% present for DE003 population					**25.67%**
% of SPA population					**4.3%**

Dark-bellied Brent goose – The Solent Disturbance Mitigation Project: Phase 1 report has recorded 1800 dark-bellied Brent goose within the Solent: 61% were recorded within the Chichester and Langstone Harbour area. By contrast, peak counts of only approximately 1 to 9 birds have been recorded within Medina estuary. Low tide WeBS count data are shown in **Table 6.25.**

Table 6.25 Dark-bellied Brent goose: WeBS wintering bird data for Medina estuary

Medina estuary (sector codes DE001, DE002 & DE003): Dark-bellied Brent goose count data					
Counts	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	4	51	92	143	**290**
Total (peak) count for Medina estuary (sector code DE001)					**0**
% present for DE001 population					**0%**
Total (peak) count for Medina estuary (sector code DE002)					**143**
% present for DE002 population					**49.31%**
Total (peak) count for Medina estuary (sector code DE003)					**92**
% present for DE003 population					**31.72%**
% of SPA population					**3.13%**

Teal – The Solent Disturbance Mitigation Project: Phase 1 report has recorded a maximum count of approximately 1 to 2 birds within the Medina estuary. WeBS low tide count data show higher counts as shown in **Table 6.26**.

Table 6.26 Teal: WeBS wintering bird data for Medina estuary

Medina estuary (sector codes DE001, DE002 and DE003): Teal count data					
Counts	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	-	-	23	66	**89**
Total (peak) count for Medina estuary (sector code DE001)					**2**
% present for DE001 population					**2.24%**
Total (peak) count for Medina estuary (sector code DE002)					**7**
% present for DE002 population					**7.86%**
Total (peak) count for Medina estuary (sector code DE003)					**57**
% present for DE003 population					**64.04%**
% of SPA population					**1.5%**

Bird assemblage

Table 6.27 shows the bird assemblage for the Medina estuary which includes little grebe, wigeon, redshank, pintail, shoveler and lapwing. The bird assemblage also includes black-tailed godwit, for which the data can be seen in **Table 6.27**.

Table 6.27 Bird assemblage: WeBS data for Medina estuary

Medina estuary WeBS count data (Sector codes DE001, DE002 and DE003)					
Counts – Little grebe	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	18	26	17	20	**81**
Total (peak) count for sector code DE01					**6**
% present for DE01					**7.40%**

Medina estuary WeBS count data (Sector codes DE001, DE002 and DE003)					
Total (peak) count for sector code DE02					**15**
% present for DE02					**18.51%**
Total (peak) count for sector code DE03					**7**
% present for DE03					**8.64%**
Counts – wigeon	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	24	42	91	36	**193**
Total (peak) count for sector code DE01					**-**
% present for DE01					**0%**
Total (peak) count for sector code DE02					**87**
% present for DE02					**45.07%**
Total (peak) count for sector code DE03					**20**
% present for DE03					**10.36%**
Counts – redshank	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	42	40	42	36	**160**
Total (peak) count for sector code DE01					**13**
% present for DE01					**8.13**
Total (peak) count for sector code DE02					**31**
% present for DE02					**19.38%**
Total (peak) count for sector code DE03					**12**
% present for DE03					**7.5%**
Counts – grey plover	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	-	-	2	-	**2**
Total (peak) count for sector code DE01					**0**
% present for DE01					**0%**
Total (peak) count for sector code DE02					**2**
% present for DE02					**100%**
Total (peak) count for sector code DE03					**0**
% present for DE03					**0%**
Counts – dunlin	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	-	-	78	162	**240**
Total (peak) count for sector code DE01					**162**
% present for DE01					**0**

Medina estuary WeBS count data (Sector codes DE001, DE002 and DE003)					
Total (peak) count for sector code DE02					0%
% present for DE02					67.5%
Total (peak) count for sector code DE03					0
% present for DE03					0%
Counts – curlew	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	48	39	36	24	147
Total (peak) count for sector code DE01					7
% present for DE01					4.67%
Total (peak) count for sector code DE02					31
% present for DE02					21.08%
Total (peak) count for sector code DE03					10
% present for DE03					6.8%
Counts – shelduck	**November**	**December**	**January**	**February**	**Total**
Individual counts Medina estuary	-	-	2	9	11
Total (peak) count for sector code DE01					2
% present for DE01					18.18%
Total (peak) count for sector code DE02					4
% present for DE02					36.36%
Total (peak) count for sector code DE03					4
% present for DE03					36.36%

Assessment

The Drought Permit may lead to some minor alterations to the benthic invertebrate community structure and the type of prey available to wading birds in the upper section of the estuary. The main concern in this context will be a change in the saline gradient and a slight increase in the estuary flushing time, with reduced dilution of nutrients (nitrogen). Work completed for the UK Marine SACs Project concluded that although changes in salinity may affect the prey structure, it would not necessarily affect their functioning. For example, on mud flats *Nereis* may be replaced by *Nephtys* following an increase in salinity with reduced river flows. Although the species composition is seen to have changed along the environmental gradient, the community still functions as prey for the birds. However, given the nitrate vulnerable designation (eutrophic) of the estuary, there is a low risk of an increase in algal blooms and a change phytoplankton and zooplankton community structures. This may impact the abundance and type of prey available, therefore potentially interfering with bird feeding patterns[115].

With regard to the Favourable Condition Tables, the targets that could be impacted by the Drought Permit are considered to be:

[115] http://www.ukmarinesac.org.uk/pdfs/sandmud.pdf

- **Annex I species: Saltmarsh – Food availability (prey species)** - Mediterranean gulls in particular forage in saltmarsh areas for small fish, and invertebrates such as worms, snails, and insects.
- **Annex I species: Intertidal mudflats and sandflats – Food availability (prey species)** - Mediterranean gulls in particular forage over mudflat and sandflat areas for small fish, and invertebrates such as worms, snails and crustaceans.
- **Waterfowl assemblage: Saltmarsh – Food availability (prey species)** - *Aster trifolium*, *Spergularia*, *Puccinellia*, *Triglochin*, *Plantago*, and *Salicornia* spp. are important food plants for dark-bellied brent geese. Soft-leaved and seed-bearing plants such as *Salicornia* spp. and Atriplex are important food plants for teal. A number of overwintering and passage birds feed on invertebrates and small fish within the saltmarsh communities.
- **Waterfowl assemblage: Intertidal mudflats and saltmarsh – Food availability (prey species)** - Most of the waders and waterfowl within the assemblage, including the internationally important regularly occurring migratory birds feed on invertebrates within and on the sediments. Black-tailed godwit for example, feed primarily on bivalve molluscs such as *Macoma*, *Cardium* and annelid worms such as *Nereis* whereas small isopods such as *Gammarus* and *Tubifex* worms are important prey species for ringed plover. Wigeon and brent geese however graze on green algae (*Enteromorpha* and *Ulva* spp.), the latter preferring eelgrass (*Zostera* spp.) which grows on the sediment.

Consideration has been given to each of the qualifying species and is detailed in **Tables 6.28** and **Table 6.29** below.

Table 6.28 Potential effects on breeding Mediterranean gull

DESIGNATED SITE: Solent and Southampton Water SPA REF: UK9011061		PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar	
Potential Effect	Significance	Specific Mitigation	Residual Effect after Mitigation
Changes in prey abundance and prey species dominance as a result of reductions in freshwater flow inputs to the estuary (habitat degradation).	International Union of Conservation for Nature (IUCN) data indicate that the diet of Mediterranean gull includes terrestrial and aquatic invertebrates, gastropods, fish, earthworms, berries and small rodents. While changes in estuarine conditions may result in changes to prey availability and dominance it is considered unlikely that such changes would significantly affect the foraging success of the breeding population of Mediterranean gulls as this species is likely to change prey preferences in accordance to availability. Therefore, the varied and opportunistic diets of these species ameliorate the impact that the drought permit may have on littoral mudflat macroinvertebrate species (such as annelid worms). Given the timescales proposed for the Drought Permit and the temporal extent of the effects of a reduction in freshwater input to the estuary (i.e. at low tide only), it is considered that changes in prey availability and dominance will be of minor impact magnitude, temporary and unlikely to have any significant long-term effect upon the favourable conservation status of this species.	None required	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.
Loss and/or degradation of breeding habitat	Mediterranean gull typically nests near water on flood-lands, fields and grasslands (del Hoyo *et al*. 1996[116], Snow and Perrins 1998[117]) and on wet or dry areas of islands (Snow and Perrins 1998), favouring sparse vegetation but generally avoiding barren sand (del Hoyo *et al*. 1996). Nest sites themselves tend to be formed within a shallow depression, situated on the ground in sparsely vegetated sites. While nest sites are associated with estuarine habitats present within Newtown estuary it is not considered that changes to the condition of these habitats would arise as a result of the Drought Permit sufficient to affect nest site selection of this species nor are any other physical or habitat changes considered likely to significantly affect breeding success.	None required.	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.

Table 6.29 Potential effects on SPA wintering birds

DESIGNATED SITE: Solent and Southampton Water SPA REF: UK9011061		PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar		
Potential Effect	Significance	Monitoring	Mitigation	Residual Effect after Mitigation
Changes in prey/food resource abundance and prey species dominance as a result of reductions in freshwater flow of the estuary.	***Dark-bellied Brent goose*** WeBS data indicate that the Medina estuary accounts for approximately 3.13% of the total SPA population of this species. The Phase II report for the Solent Disturbance Mitigation Project[118] recognises the importance of inter-tidal and terrestrial food sources for this species as the autumn/winter season progresses, highlighting the fact that terrestrial food sources are used extensively in late winter when coastal resources are depleted. The species is known to feed on macroalgae and angiosperms associated with estuarine environments, such as eelgrass (*Z. marina*). Given the preference for macroalgae as an initial food source on arrival (easily digestible and high in protein) to regain any weight loss[119], the additional coverage or persistence of algal blooms is unlikely to impact the feeding patterns of this species.	None required	• Continued compliance with nitrogen stripping at Peel Common STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Consider specific measures that can be implemented in Medina catchment to reduce nitrogen and/or phosphorous.	No adverse effect to the SPA site integrity and the ability to meet the favourable conservation status will not be impeded.
	Teal WeBS data indicate that the Medina Estuary accounts for approximately 1.5% of the total SPA population of this species. Flocks of teal gather from August onwards in Solent and Southampton, with particularly important numbers in Newtown Harbour. Teal are a generalist feeder and are known to eat a wide range of food and prey items, ranging from terrestrial and aquatic vegetation to aquatic and terrestrial invertebrates. Given the generalist nature of the feeding characteristics of teal, it is considered unlikely that the temporary, minor magnitude of effects of the proposed Drought Permit on estuarine habitat and associated food sources will not have any significant negative effect upon the foraging success of the teal population associated with the Medina Estuary.	None required		
	Ringed plover WeBS data indicate that the Medina Estuary accounts for approximately 0.18% of the SPA population of this species of this species. This species is omnivorous and not exclusively estuarine, preying upon insects such as flies and spiders, alongside estuarine invertebrates such as polychaete worms, Crustacea and molluscs. However, being a wading bird, it is likely to be more sensitive to changes in prey abundance and composition potentially caused by the Drought Permit. The more sheltered inner reaches of the estuary are likely to provide a favourable habitat for these wading birds. The exact number of individuals that might be expected to overwinter in the Medina estuary is unknown. Given the potential for some adverse effects on the littoral mudflats of the more sheltered upper	• Wintering bird surveys to determine use of Medina Estuary by ringed plover. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish		

[116] del Hoyo, J., Elliott, A., and Sargatal, J. 1996. Handbook of the Birds of the World
[117] Snow, D.W.; Perrins, C.M. 1998. The Birds of the Western Palearctic, Volume 1: Non-Passerines
[118] Liley, D., Stillman, R. & Fearnley, H. (2010). The Solent Disturbance and Mitigation Project Phase 2: Results of Bird Disturbance Fieldwork 2009/10. Footprint Ecology / Solent Forum
[119] English Nature (2001) Solent European Marine Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

DESIGNATED SITE: Solent and Southampton Water SPA REF: UK9011061		PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Eastern Yar		
Potential Effect	Significance	Monitoring	Mitigation	Residual Effect after Mitigation
	estuary in Medina estuary due to the drought permit, and the unknown number of birds using the estuary, the impact is assessed as uncertain.	location, composition, abundance and condition of the mudflat habitat communities present in the Medina Estuary. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
	Black-tailed godwit WeBS data indicate that the Medina Estuary accounts for approximately 4.3% of the total SPA population of this species. The omnivorous diet of this species mainly includes infaunal polychaete worms and snails, but also includes some plants, beetles, grasshoppers and other small insects during the breeding season. *Hediste diversicolor* are an important prey item for black tailed godwits and infaunal bivalve molluscs, such as cockles (*Cerastoderma edule*) and Baltic tellin (*Macoma baltica*) are also favoured, however it is not considered exclusively estuarine. Being a wading bird, it is likely to be more sensitive to changes in prey abundance and composition potentially caused by the Drought Permit. The more sheltered inner reaches of the estuary (including in Medina Estuary) are likely to provide a favourable habitat for these wading birds. Flocks gather from mid-July to feed on the intertidal mudflats[120] and therefore an increase in extent of algal blooms, or increased persistence into the autumn changing the benthic invertebrate communities could result in a change in the feeding patterns of black-tailed godwit. However, it is noted that the low numbers of black-tailed godwit recorded within Medina Estuary suggest this part of the estuary system is of limited value for foraging purposes for this species. It is therefore considered highly unlikely that the temporary and localised changes in prey community composition in Medina Estuary will significantly affect the foraging success of this species.	• Wintering bird surveys to confirm numbers of black-tailed godwit using Medina Estuary • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in Medina Estuary. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
	Bird Assemblage Peak count data provided by WeBS indicates that the Medina Estuary supported approximately 0.76% of the total assemblage associated with the SPA (based on JNCC count data). Although total and peak count information provided by WeBS indicates that the Medina Estuary is generally of low value to the overwintering bird assemblage associated with the SPA, an increase in extent of algal blooms, or increased persistence into the autumn changing the benthic invertebrate communities could result in a change in the feeding patterns for these species.	• Wintering bird surveys to confirm numbers of redshank, shelduck, dunlin, grey plover and curlew using Medina Estuary. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in Medina Estuary. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
Habitat degradation – loss of roosting sites	***Dark-bellied Brent Goose*** The Phase II report indicated that the loss of terrestrial habitat typically has the highest effect on survival and therefore such habitat is considered to be particularly important for this species. The Drought Permit will not have any adverse effects on terrestrial habitat and therefore no impacts on roosting sites.	None required	None required	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.
	Teal Non-breeding Teal favour areas of shallow water on estuarine coastal lagoons, coastal and inland marshes, and flooded pastures and ponds. The potential area of mudflats and saltmarsh that the Drought Permit could impact is considered to be small, with alternative habitat available for roosting.	None required		
	Ringed Plover and Bar tailed Godwit Both species are known to roost in saltmarsh habitat. However, this is typically in the upper marsh, where sward height is of particular importance. As the Drought Permit will not affect the upper marsh areas, there will be no adverse effects to the availability of roost sites for these species.	None required		

[120] English Nature (2001) Solent European Marine Site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

Solent and Southampton Water Ramsar site

Baseline

Qualifying features of the Ramsar site relevant to this Appropriate Assessment have been presented earlier in **Table 6.13.** There are two key criteria for which this site is designated.

- **Ramsar criterion 1**: this site is one of the few major sheltered channels between a substantial island and mainland in European waters, exhibiting an unusual strong double tidal flow and has long periods of slack water at high and low tide. It includes many wetland habitats characteristic of the biogeographic region: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs.
- **Ramsar criterion 2**: this site supports an important assemblage of rare plants and invertebrates. At least 33 British Red Data Book invertebrates and at least eight British Red Data Book plants are represented within the site.

  Qualifying bird species: ringed plover (peak counts in spring/autumn) and dark-bellied Brent goose, Eurasian teal, black-tailed godwit (peak counts in winter).

The site has also been designated based on the following criterion:

- **Ramsar criterion 5**: Assemblages of international importance which include species with peak counts in winter. This includes 51,343 waterfowl.
- **Ramsar criterion 6**: Qualifying Species/populations (as identified at designation) with peak counts in spring/autumn: ringed plover, (*Charadrius hiaticula)*, Europe/Northwest Africa 397 individuals, representing an average of 1.2% of the GB population. Species with peak counts in winter: Dark-bellied Brent goose, 6,456 individuals, representing an average of 3% of the population; Eurasian teal, NW Europe 5,514 individuals, representing an average of 1.3% of the population; Black-tailed godwit, Iceland / Western Europe 1,240 individuals, representing an average of 3.5% of the population.

The Ramsar site includes the Medina Estuary: the supporting habitat of criterion 1 and the designated bird species of criterion 5 and 6 present in the Medina estuary have already been discussed in relation to the SAC and SPA sites above. It is currently unclear how many of the rare plants and invertebrate species specified under criterion 2 are present in the Medina estuary (data requested but not available at the time of writing).

Assessment

The potential impacts upon the relevant criterion 1 and 2 features of the Ramsar site present in the Medina Estuary are not considered to significantly alter from those described for qualifying features of the SAC and SPA as described in Sections 6.4.4 and 6.4.5.

The potential impacts upon wintering bird species and assemblages of the Ramsar site are discussed above under the Solent and Southampton Water SPA assessment. The potential effects on the criterion 5 and 6 bird species are not considered to significantly alter from those described for qualifying features of the SPA in Section 6.4.7.

Table 6.30 assesses those species that are not covered by the SAC or SPA designations.

Table 6.30 Potential Impact on Ramsar Criteria (not covered by SAC or SPA designations)

Potential Effect	Significance	Monitoring	Mitigation	Residual Effect after Mitigation
Changes in abundance and distribution as a result of reductions in freshwater flow of the estuary.	Important assemblage of rare plants and invertebrates. At least 33 BRDB invertebrates and at least eight BRDB Book plants are represented on site. Invertebrates: • *Allomelita pellucida, Gammarus insensibilis Nematostella vectensis, Arctosa fulvolineata, Aulonia albimana, Anthonomus rufus, Baris analis, Cantharis fusca, Drypta dentata, Leptura fulva, Meligethes bidentatus, Staphylinus caesareus, Aphrosylus mitis, Dorycera graminum, Haematopoda grandis, Hippobosca equina, Linnaemya comta, Stratiomys longicornis, Syntormon mikii, Tetanocera freyi, Villa circumdata, Trachysphaera lobata, Paludinella littorina, Truncatellina cylindrica, Andrena alfkenella, Elachista littoricola, Melissoblaptes zelleri, Platytes alpinella, Psamathrocrita argentella, Armandia cirrhosa.* Unlikely to be impacted by the Drought Permit as typically associated with marine habitat but presence in Shalfleet Creek needs to be confirmed through survey.	Invertebrate surveys at sampling points in the upper Medina Estuary to confirm presence, distribution and abundance.	• Continued compliance with nitrogen stripping at Peel Common STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Consider specific measures that can be implemented in Medina catchment to reduce nitrogen and/or phosphorous.	No adverse effect to the Ramsar site integrity and the ability to meet the favourable conservation status will not be impeded.
	• *Anisodactylus poeciloides, Berosus spinosus, Paracymus aeneus, Atylotus latistriatus, Acleris lorguiniana* Potential to be impacted by the Drought Order as species are associated with saltmarsh but presence in Shalfleet Creek needs to be confirmed through survey.	Invertebrate surveys at sampling points in the upper Medina Estuary to confirm presence, distribution and abundance.		
	Plants: *Eleocharis parvula, Geranium purpureum forsteri, Lotus angustissimus, Ludwigia palustris, Orobanche purpurea, Lamprothamnium papulosum, Spartina maritima Zostera marina* A number of these species are unlikely to be found in the mudflat and saltmarsh habitats that could be impacted by the Drought Permit; *Geranium purpureum forsteri* (rocky habitat), *Lotus angustissimus* (sea cliffs), *Orobanche purpurea* (grassland) and *Lamprothamnium papulosum* (coastal waters). *Eleocharis parvula, Ludwigia palustris*, *Spartina maritima* and *Zostera marina* could be impacted by the Drought Permit. Survey work completed in 2013 did not record these species as being present in Shalfleet Creek, however update surveys should be completed to confirm absence within the zone of influence of the Drought Permit i.e. downstream to Shalfleet Quay.	Vegetation surveys in the upper Medina Estuary to confirm presence.		
Changes in abundance and distribution as a result of reductions in freshwater flow of the estuary.	Little egret (peak count spring/autumn) The coastal diet of this species is identical to other heron species and includes fish fry, crustaceans and amphibians. As the species is not reliant on mudflat benthic invertebrates, there will be no adverse effect on the foraging success of the population.	None required	• Continued compliance with nitrogen stripping at Peel Common STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Consider specific measures that can be implemented in Medina catchment to reduce nitrogen and/or phosphorous.	No adverse effect to the Ramsar site integrity and the ability to meet the favourable conservation status will not be impeded.
	Spotted and common redshank (peak count spring/autumn and winter respectively) Wading birds attracted to Shalfleet Creek at low water are likely to include significant numbers of redshank and are known to feed on the intertidal mudflats[121]. Although total and peak count information provided by WeBS indicates that Medina Estuary is generally of low value to the overwintering bird assemblage associated with the Ramsar, an increase in extent of algal blooms, or increased persistence into the autumn changing the benthic invertebrate communities could result in a change in the feeding patterns for these species.	• Bird surveys to confirm numbers of redshank, species using upper Medina Estuary. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in the upper Medina Estuary. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.		
	Water rail (peak count in winter) This species will not be affected by changes in invertebrate communities on the mudflats as it is an inhabitant of wetlands	None required.		

121 Environment Agency (2005) Review of Consents, Part B Functional Assessments: Water Resources Appropriate Assessment Solent & Southampton Water SPA.

Monitoring and Mitigation

As set out above, there are a number of specific monitoring and mitigation measures that need to be implemented.

Details of the proposed baseline survey work were issued to Natural England in February 2019 for agreement, with some work having already been completed during winter 2018-2019 within the optimal survey window (wintering bird surveys). The outline for the mitigation package has been agreed, but discussions are ongoing to establish the specific elements, and will be informed by the outstanding baseline survey results. Baseline monitoring is continuing in 2021 and 2022, throughout this period information will be shared with Natural England to help develop mitigation packages.

This proposition takes account of the frequency of Drought Permit implementation (as opposed to application, which could be more frequent) of the Eastern Yar Drought Permit, which (subject to final confirmation) would be no more frequently than **once in every 180-200 years**. In addition, the WRMP19 measures for the Isle of Wight aim to reduce this frequency still further during the second half of the 2020s.

The accompanying Environmental Assessment Report also sets out the proposed monitoring that would be required for the European sites if the Drought Permit was implemented such that actual effects can be compared with the predicted scale of effects in this Appropriate Assessment. Monitoring would be carried out at the on-set of a drought to provide the drought conditions baseline, during Drought Permit implementation and post-Drought Permit implementation.

The Integrity Test

The integrity of the site is: "*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified*"

Overall, it is considered that there will be no adverse effects arising from the proposed Drought Permit on the conservation objectives of the qualifying features of the Solent Maritime SAC, Solent and Southampton Water SPA, or Solent and Southampton Water Ramsar site and thus **no adverse effect on site integrity is expected.**

In-combination effects

There is the potential for in-combination effects with the Caul Bourne WSW Drought Permit as discussed in Sections 6.7 to 6.8 below. No other in-combination effects with other activities, plans or programmes have been identified.

Conclusions

Based on current level of information regarding the proposed Drought Permit and the assessed impacts upon qualifying features of designated sites discussed above, it is recommended that no further work under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 is required.

It is however recognised that some baseline monitoring surveys have been recommended to further inform the impact assessment for the Drought Permit. The findings from this further work should be used to review the conclusions of this plan-level Appropriate Assessment which would need to be updated prior to any actual application for a Drought Permit with the new evidence.

6.7 Darwell Drought Permit Appropriate Assessment

In order to protect public water supplies within Southern Water's Sussex Hastings Water Resources Zone in the event of a future severe drought, Southern Water may need to apply to the Environment Agency for a Drought Permit, either during spring or summer, to increase abstraction from the River Rother by amending the Minimum Residual Flow (MRF) conditions. **Table 6.31** summarises the key components of the Darwell Drought Permit - further details are set out in the Drought Plan 2022 and accompanying Environmental Assessment Report for this Drought Permit option.

The scope of the Appropriate Assessment of the effects of the Drought Permit on European sites has been developed from the conclusions of the HRA screening assessment (as reported in Sections 4 and 5 above), and in consultation with Natural England on the Draft Plan 2019 (April and June 2019). A summary of the qualifying features screened in for the Appropriate Assessment is provided in **Table 6.31**, i.e. those qualifying features sensitive to the effects of the Drought Permit where the HRA screening assessment was unable to confirm there would be no likely significant effects on site integrity.

Table 6.31 Summary of proposed Darwell Drought Permit and Appropriate Assessment scope

	Darwell Drought Permit
Drought Order details	The Drought Permit would authorise Southern Water to increase abstraction from the River Rother by reducing the Minimum Residual Flow conditions on the river as follows: Option 1: June – September (summer) • Reduce MRF from 28.5Ml/d to 18.5Ml/d Option 2: October to February (winter) • Maintain MRF of 4.545Ml/d and increase daily licence from 56.8Ml/d to 70Ml/d to capture more water under high flow events o 13.2Ml/d
European sites screened in for	Dungeness, Romney Marsh and Rye Bay SPA Dungeness, Romney Marsh and Rye Bay Ramsar Dungeness SAC

Darwell Drought Permit	
Appropriate Assessment[122]	
Qualifying features screened in for Appropriate Assessment[123]	Dungeness, Romney Marsh and Rye Bay SPA **Article 4.1:** • Bewick's swan *Cygnus columbianus bewickii* 155 individuals 1.9% GB population – wintering • Bittern *Botaurus stellaris* 5 individuals 5.0% GB population – wintering • Hen harrier *Circus cyaneus* 11 individuals 1.5% GB population – wintering • Golden plover *Pluvialis apricaria* 4,050 individuals 1.6% GB population – wintering • Ruff *Philomachus pugnax* 51 individuals 7.3% GB population – wintering • Marsh harrier *Circus aeruginosus* 4 females – breeding 2.0% GB population • Mediterranean gull *Larus melanocephalus* 56 pairs – breeding 52.2% GB population • Common tern *Sterna hirundo* – breeding 2.7% GB population **Article 4.2:** • Shoveler *Anas clypeata* 485 individuals – wintering 1.2% NW & C Europe (nonbreeding) **Assemblage qualification (in addition to the above):** In the non-breeding season, the area is regularly used by 34,625 individual waterbirds, including (but not limited to): • European white-fronted goose *Anser albifrons* • wigeon *Anas penelope* • gadwall *Anas strepera* • pochard *Aythya ferina* • little grebe *Tachybaptus ruficollis* • great crested grebe *Podiceps cristatus* • cormorant *Phalacrocorax carbo* • coot *Fulica atra* • lapwing *Vanellus* • sanderling *Calidris alba* • whimbrel *Numenius phaeopus* • common sandpiper *Actitis hypoleucos.* Dungeness, Romney Marsh and Rye Bay Ramsar **Ramsar criterion 2:** The site consists of a complex network of wetland habitats including saltmarsh, natural freshwater pits, fens, ponds, gravel pits, and grazing marsh and ditches. They support rich and diverse assemblages of bryophytes, vascular

[122] It was confirmed during a meeting with Natural England and Environment Agency in November 2018 that the Denge Marsh Sewer is not supplied by the Royal Military Canal, and therefore will not be subject to any water supply restrictions as a result of the implementation of the drought permit. Similarly, the mapping of the ditch network provided by the Environment Agency shows no connection between the Royal Military Canal and the ditches on the Lydd Ranges. The last sewer in the system to be connected to the Royal Military Canal is Jury's Gut. Therefore, no LSEs to the holly wood at Lydd Ranges have been identified.

[123] The scope of the Appropriate Assessment was agreed with Natural England (Jo Dear) in April 2019 and reviewed again on 13.06.2019.

Darwell Drought Permit	
	plants and invertebrates that are rare, threatened, listed as priority species in the UK Biodiversity Action Plan (BAP) or specially protected under the Wildlife and Countryside Act 1981. Important areas for these assemblages include the gravel pits, ditches and shingle wetlands at Dungeness and Rye Harbour, the **grazing marsh and ditches** of **Walland Marsh**, Dengemarsh and Pett Level, ponds throughout the site, the **Royal Military Canal**, and the saltmarshes of the River Rother. **Ramsar criterion 2: Threatened ecological communities:** • Saltmarshes and other brackish wetlands are particularly rich, with at least eight nationally scarce species, including the vulnerable sea barley *Hordeum marinum*, Borrer's saltmarsh-grass *Puccinellia fasciculata* and slender hare's-ear *Bupleurum tenuissimum*, and the near-threatened sea-heath *Frankenia laevis*. • Grazing marshes support the nationally rare (and critically endangered) sharp-leaved pondweed *Potamogeton acutifolius* and at least six nationally scarce species, including the vulnerable divided sedge *Carex divisa* and rootless duckweed *Wolffia arrhiza*. • Invertebrates (reed beetles *Donacia*, snail-killing flies (*Sciomyzidae*) and soldier flies (*Stratiomyidae*) **Ramsar criterion 2: nine individual wetland species:** • Greater water-parsnip *Sium latifolium* • Water vole *Arvicola amphibious* • Medicinal leech *Hirudo medicinalis* • Great crested newt *Triturus cristatus* • Marsh mallow moth *Hydraecia osseola hucherardi* **Ramsar criterion 5:** In the non-breeding season, the site regularly supports 34,957 individual waterbirds (5 year peak mean 2002/3 – 2006/7) **Ramsar criterion 6:** • Mute swan *Cygnus olor* 348 individuals wintering – 1.1% GB population • Shoveler *Anas clypeata* 485 individuals wintering – 1.2% NW and C Europe population <u>Dungeness SAC</u> • Great crested newt Triturus cristatus

Conservation objectives and Site Improvement Plan measures

<u>Conservation objectives:</u>
Conservation objectives have been developed for both the Dungeness, Romney Marsh and Rye Bay SPA[124] and Dungeness SAC[125].

The conservation objectives for the SPA are set to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features.

[124] Natural England (2016). European Site Conservation Objectives for Dungeness, Romney Marsh and Rye Bay Special Protection Area and potential Special Protection Area Site Code: UK9012091
[125] Natural England (2018) European Site Conservation Objectives for Dungeness Special Area of Conservation Site Code: UK0013059. Version 3.

- 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.
- The distribution of the qualifying features within the site.

To ensure that the integrity of the SAC is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, the following must be maintained or restored:

- 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.

Supplementary advice is available on Natural England's designated sites webpage for the SAC and SPA only. It identifies attributes and targets for each qualifying features that must be met to achieve favourable status. Background information has also been used from the Regulation 33 package for the European Marine Site published in 2001[126]. It should be noted that the Regulation 33 package was produced prior to the SPA designation being extended in 2016, and the attributes relate specifically to the marine component of the SPA.

Supplementary advice is not available for the Ramsar, and the qualifying features are not adequately covered by the information available for the SPA (or SAC). Therefore, the Favourable Condition Tables (FCTs) for the underlying SSSI have been used to inform the assessment for those features it covers.

Site Improvement Plan:
Site Improvement Plans (SIPs) have been developed for each Emerald site in England as part of the Improvement Programme for England's Emerald sites (IPENS). SIPs have not been specifically produced for Ramsar sites.

A total of 14 issues have been prioritised for the SAC and SPA[127]. The prioritised issues and affected features that are of importance in relation to the proposed Darwell drought permit include:

- **Changes in species distributions** for the following species: (A037(NB) Bewick's swan, A056(NB) shoveler, A176(B), Mediterranean gull, A193(B) common tern and A195(B) little tern).
- **Invasive species** for the following species: A037(NB) Bewick's swan, A056(NB) Shoveler, A176(B) Mediterranean gull, A193(B) Common tern, A195(B) Little tern, H1210 Annual vegetation of drift lines, H1220 Coastal shingle vegetation outside the reach of waves, S1166 Great crested newt.

[126] English Nature's advice for Dungeness to Pett Level European marine site given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (2001)
[127] Natural England (2019). Improvement Programme for England's Natura 2000 Sites (IPENS) Planning for the Future Site Improvement Plan: Dungeness. www.naturalengland.org.uk/ipens2000

- **Inappropriate water levels** for the following species: (A037(NB) Bewick's swan, A056(NB) shoveler, A176(B) Mediterranean gull, A193(B) common tern, A195(B) little tern), S1166 Great crested newt.
- **Inappropriate ditch management** for the following species: (A037(NB) Bewick's swan, A056(NB) shoveler, A176(B), Mediterranean gull, A193(B) common tern, and A195(B) little tern).
- **Water Pollution** for the following species and habitats: (A037(NB) Bewick's swan, A056(NB) shoveler, A176(B), Mediterranean gull, A193(B) common tern, A195(B) little tern)
- **Fisheries of commercial, marine and estuarine importance** in relation to**:** (A037(NB) Bewick's swan, A056(NB) shoveler, A176(B) Mediterranean gull, A193(B) common tern, A195(B) and little tern).
- **Predation** risks to the following species: (A132(B) avocet, A176(B) Mediterranean gull, A191(B) sandwich tern, A193(B) common tern, and A195(B) little tern).

Hydrological Assessment

Hydrological Reach 5 – Royal Military Canal and wider Walland Marsh ditch system

Hydrological Reach 5 comprises the Royal Military Canal (and its associated pumped flow support from the River Rother at Iden Lock) and the wider system of sewers and carriers across the Walland Marsh. The key operational management of water flow into the Royal Military Canal is the pumping of water from the River Rother at Iden Lock, which ceases when water levels reach 0.8mAOD in the River Rother, although the target water level for navigational purposes is 1.2mAOD. Water is pumped from the Royal Military Canal into the marsh drainage system to help maintain water levels which are also supported by flows from springs.

Summer Option (reduction of 18.5 Ml/d)

Pumping may have been possible from the River Rother during the preceding April and May to help build up a reserve of water storage in the marsh drainage system. It is highly likely that water levels would already be below the 0.8mAOD level at which pumping ceases at Iden Lock prior to implementation of the summer Drought Permit – consequently, there would be no immediate effects on the marsh system and only if flows start to increase in the River Rother later during the Drought Permit implementation period. The summer Drought Permit may therefore reduce the ability to pump water at Iden Lock to the marsh system if river flows start to increase later in the summer implementation period. The magnitude and duration of the impact will depend on the prevailing flow conditions that would occur in drought conditions but without the drought permit in place. Due to the lack of historic data on water levels at Iden Lock and pumping volumes, a quantified assessment of the impact is not currently possible but the impact is considered to be **moderate (but uncertain due to the lack of historic data)**.

Winter Option (Maintain MRF of 4.545Ml/d and increase daily licensed rate from 56.8 Ml/d to 70Ml/d)

During October to February the demand for water from land owners will be reduced. There is no proposed reduction in the winter MRF and the permit will only impact flows once they approach the Q50 flow. Therefore, the impact is considered to be **negligible**.

Hydrological Reach 6 – River Rother (Scots Float into Rye Harbour)

Hydrological reach 6 is the tidal zone (transitional water) from Scots Float sluice into the Rye estuary. The impact of the Drought Permit on the estuary has been assessed based on the percentage reduction to freshwater flows expected at Reach 4 (Hexden Channel to Scots Float).

Summer MRF Reduction

The impact of the summer Drought Order on the estuary has been assessed based on the percentage reduction to freshwater flow expected at Reach 4 (Hexden Channel to Scots Float) – a 19% reduction in Q_{95} flows - but also taking account of the likely drought operation of Scots Float sluice. It is understood from discussions with the Environment Agency (November 2018) that Scots Float sluice is normally closed under low flow and drought conditions in order to maintain levels within the River Rother for navigation (although a small amount of water nevertheless passes downstream into the estuary). Given this river management action, it is considered unlikely that the reduced flows in the River Rother due to Drought Order implementation in a severe drought will have any material impact on the already negligible freshwater flow to the estuary. Consequently, the impact upon the hydrological conditions in the estuary is assessed as no greater than **minor**; specifically, in relation to effects on the salinity gradient in the upper estuary, as well as on the wetted width and flow connectivity of the low tide channel. It is not considered that the flushing time of the estuary would be significantly impacted against the baseline of drought conditions and the management of flows to the estuary at Scots Float.

In summary, as a result of the summer Drought Permit implementation there could be a reduction in the intermittent freshwater low flows passing through Scots Float into the upper estuary. This could specifically impact upon the salinity gradient, wetted width and flow connectivity of the low tide channel. It is not considered that the flushing time of the estuary would be significantly impacted against the baseline of drought conditions. This is assessed as a **minor** impact on the WFD transitional waterbody. These potential impacts must, however, be considered in the context that the River Rother is one of three waterbodies contributing freshwater flow to the estuary each of which is subject to flow management in the form of tidal gates. Therefore, it is the upper estuary, prior to the confluence with the Rivers Brede and Tillingham, which is most at risk to these potential impacts.

Winter Option (increase daily licensed rate from 56.8 Ml/d to 70Ml/d reduction of 13.2Ml/d)

The impact of the winter drought permit on the estuary has been assessed as **negligible** as there will be no reduction to freshwater flow expected at Reach 4 (Hexden Channel to Scots Float) under Q95 flow conditions.

Dungeness, Romney Marsh and Rye Bay SPA and Ramsar

Baseline

Limited up to date baseline data is available for the Ramsar qualifying features, and the need for additional baseline survey and monitoring has been reflected in the assessments. Information on the features has been taken from the underlying SSSI citation and the supporting information provided to the notification package and survey results posted on the Romney Marsh Countryside Partnership website. However, these data are not current (results date from ~2001) and not in sufficient detail to identify presence of species in the ditches likely to be affected by the drought permit/s.

Wetland bird count data was sourced from WeBS for the following survey sectors; Rye Harbour, Camber and East Guldeford, Fairfield, Scotney and Lydd West and Walland Marsh. Walland Marsh and Fairfield are no longer routinely monitored and therefore data only exists up to 2009 and 2015 respectively, and the Royal Military Canal – Appledore to Warehorne has been identified as a vacant site.

Assessment

The proposed Drought Permit will not have an impact on all of the qualifying features of the SPA, and similarly not all criteria or all qualifying features within each criterion of the Ramsar. The proposed Drought permit will not affect any of the qualifying features within criterion 1.

The annual vegetation of drift lines and coastal fringes of perennial vegetation of stony banks are both habitats found along the shoreline and largely driven by coastal processes. The natural shingle wetland: saline lagoons and basin fens habitat is found within the Dungeness RSPB reserve and Lydd Ranges, which are not hydrologically connected to the River Rother or wider ditch network.

Water levels across the marshes are heavily managed by the Environment Agency, Internal Drainage Board and individual land owners. The ditch system is described in the SSSI citation as being an important example of lowland, slow-moving and eutrophic (nutrient-rich) waters. The Dowels contains the greatest proportion of freshwater ditches on Walland Marsh with the highest plant diversity (sharp-leaved pondweed, greater water parsnip and marsh mallow plant). The areas of Snargate, Fairfield, Woolpack and Cheyne Court contain a less diverse brackish assemblage. The ditches at East Guldeford are less brackish than those in the areas listed above, and where ungrazed margins occur, important stands of marsh mallow occur. Walland Marsh is cited as supporting sharp-leaved pondweed, greater water parsnip, vulnerable divided sedge and rootless duckweed. The ditch network as a whole provides a complex, and interconnected, mosaic of habitats which in itself forms a qualifying feature of the Ramsar. The ditch network in turn supports diverse assemblages of vascular plants, invertebrates, rare and protected species and waterfowl.

The Drought Permit may alter the pumping regime used to keep water levels high in the ditch network during the spring and summer months. Water is pumped from the River Rother to the ditch network at Iden Lock and conveyed into the marsh system by the Royal Military Canal, with a pumping limit set at Iden Lock of 0.8mAOD to retain levels for navigation in the River Rother. The typical pumping period is between May and July, although pumping can commence earlier if preceded by a dry winter.

The extremities of the ditch system are likely to be subject to the most impact with the marsh areas supplied by Jury's Gut, Guldeford Sewer, White Kemp Sewer and Five Watering Sewer likely to be most susceptible to an increased risk of drying, desiccation and water quality issues. If the summer MRF reduction Drought Permit is not required following the spring drought permit, then pumping from the River Rother may be able to resume in June if flows increase and water levels at Iden Lock increase above 0.8mAOD. Impacts to winter flooding of the grazing marshes due to the Drought Permit may occur as a result of a lowering of the water table whilst the permit is in place.

The winter MRF Drought Permit could either be implemented without being preceded by the summer Drought Permit but equally could follow on after it. In the latter scenario, the impacts of the summer Drought Permit would be compounded by the winter Drought Order, with pumping not being able to resume until the permit ceases and flows increase in the River Rother during the winter. In the scenario with no preceding summer Drought Permit, the ditch system may have some extra resilience as water may have been proactively pumped in May (and potentially April) to build up the water levels.

Pumping normally ceases in the autumn/winter as the water levels need to be managed to reduce flood risk issues. However, after implementation of the summer and winter Drought Permits, pumping may be required to facilitate the wet grazing marsh required for the overwintering bird populations (assuming water levels in the River Rother recover post-drought to allow pumping to take place at Iden Lock).

A reduction in water supply from the River Rother to the marsh ditch network is likely to result in the minimum water depth targets not being met across a proportion of the drainage system.

The Royal Military Canal is less likely to be affected due to its size and position in the network as the predominant water conveyance route for the marsh system. Similarly, it is considered that the area of The Dowels is less likely to be affected as it is fed directly from the Royal Military Canal and positioned at the "head" of the system. It is therefore considered that the ditch systems fed by the following sewers are likely to be affected, and the sewers themselves could experience a drop in levels; Jury's Gut, White Kemp Sewer – Walland Marsh, Guldeford Sewer – East Guldeford Levels and Five Watering Sewer – Fairfield.

The reduction in the water supply from the River Rother is likely to exacerbate the issues over and above those experienced in a natural drought. Water in the ditch system will pond, with some areas becoming isolated, and with smaller ditches at the extremity of the system likely to dry up altogether. In-channel, emergent and marginal vegetation will be subject to desiccation, particularly those which are shallow rooted and exposed to drying soils.

It is difficult to quantify the impacts specifically due to an absence of historic data on dry year water levels across the ditch network, and these are subject to various levels of control that will change annually to reflect prevailing conditions, depending on the susceptibility of the ditch network to drying out.

A further potential concern is the minor impact on freshwater inputs to the estuary which drives zonation and community structure within the saltmarsh habitat which supports a number of macroinvertebrates and fish that, in turn, support a diversity of resident and migratory birds. The hydrology assessment has identified minor impacts to this reach during the summer if the drought permit were to be implemented. However, it is understood that during the summer that freshwater influx from the River Rother is stopped from entering the estuary at Scots Float in order to retain water levels upstream in the river. Consequently, the change to the freshwater flow to the estuary is small as a result of the drought permits. Therefore, impacts on the Ramsar features associated with the transitional water (e.g. saltmarsh) are unlikely to arise due to implementation of the Drought Permit.

Table 6.32 provides an assessment for each of the Ramsar qualifying features considered to be affected by the Drought Permit that do not have specific targets and attributes, **Table 6.33** for those features that do have specific targets (taken from the Dungeness, Romney Marsh and Rye Bay SSSI FCTs), and **Table 6.34** the SPA features.

Dungeness SAC

Baseline

The known great crested newt metapopulations occur at Dungeness and Romney Warren, with breeding ponds at Dungeness located from the RSPB reserve to Lydd Airport, with some isolated ponds at Lydd Ranges and Romney Warren. As previously stated, there is no hydrological connection between the River Rother/Royal Military Canal and the Denge Marsh sewer and ditches and waterbodies at Lydd and Dungeness.

However, the network of ditches, if free of fish, could support great crested newts and scattered populations of great crested newt are known to occur in Walland Marsh, Rye Harbour, Appledore and Brookland[128], some of which occur within the boundaries of the Dungeness, Romney Marsh and Rye Bay Ramsar. It's not clear whether these populations are found in smaller ponds and waterbodies across the marsh, using terrestrial habitat to

[128] GCN records taken from Dungeness, Romney Marsh and Rye Bay SSSI, East Sussex and Kent Supporting Information A supplement to the notification package (Aug 2006) and data held on the NBN Atlas.

disperse, or whether they are present in the ditch network, and therefore susceptible to impacts from the drought permit implementation.

Assessment

As stated in Section 6.6.2, the extremities of the ditch system are likely to be subject to the most impact during implementation of the Drought Permits, with the marsh areas supplied by Jury's Gut, Guldeford Sewer, White Kemp Sewer and Five Watering Sewer likely to be most susceptible to an increased risk of drying, desiccation and water quality issues. The breeding season can commence earlier than typical, with eggs having been found in the ponds as early as January. A reduction in water levels during the egg laying and larval development months could therefore affect the viability of the great crested newt population, with a reduction in numbers.

Table 6.35 provides an assessment for great crested newt qualifying feature. Note that this has not been included in the preceding Ramsar tables as the necessary supplementary guidance is attributed to the SAC only. Consideration has been given to the underlying targets for the SSSI which will include the wider Ramsar area.

Table 6.32 Dungeness, Romney Marsh and Rye Bay Ramsar

Ramsar Criterion	Feature	Potential impact	Monitoring	Mitigation	Effect (on conservation objectives and site integrity)
Dungeness, Romney Bay and Rye Marsh Ramsar site					
2	Saltmarsh	• Limited impact as a result of freshwater influx from River Rother being stopped from entering estuary at Scots Float during dry springs and summers[129]. • River Rother upstream of Monk Bretton bridge (A259) is canalised with only narrow strips of saltmarsh consisting of low-mid marsh sea-purslane community, with some sea couch drift line community present. • Change in sediment and nutrient dynamics, and water quality as a result of drought permits over and above prevailing drought considered unlikely. Therefore, change in vegetation community structure and zonation limited.	Habitat survey – confirm connectivity of saltmarsh to channel and risk mapping of vulnerability of saltmarsh to drought impacts	Not required	No
	Lowland grazing marsh	• Lowering of water table in spring and summer which could result in a change in species composition. • Reduction in winter flooding of grazing marsh.	Considered to have low botanical interest- supports wintering bird populations – see Table 6.45 and Table 6.46	Water management protocol See Section 6.8.3.	No
2	Bryophytes (Bryum species)	• No impacts considered likely as occurs on wet sand beside large freshwater gravel pits and small pools in Dungeness RSPB Reserve therefore no hydrological connectivity with changes to freshwater flows and levels on Royal Military Canal and ditch network.	Screened out of Appropriate Assessment		
	Vascular plants	• Sea barley *Hordeium marinum*, Borrer's saltmarsh grass *Puccinellia fasciculate* and slender hare's-ear *Bupleurum tenuissimum* and the near threatened sea-heath *Frankenia laevis*). • Associated with saltmarsh habitats which will not be impacted by the drought permits given operation of Scots Float.	None required	None required	No
	Warne's thread-moss *Bryum warneum*	• A colonist on wet sand beside the margins of freshwater gravel pits in Dungeness RSPB Reserve. As the Royal Military Canal does not feed any of the sewer network within the Dungeness RSPB reserve the species will not be impacted by the drought option.	Screened out of Appropriate Assessment		
	Aquatic warbler *Acrocephalus paludicola*	• Only present on Pett Levels area of SPA and Ramsar therefore will not be impacted by Darwell drought option	Screened out of Appropriate Assessment		
	Ground beetle *Omophron limbatum*	• Species living in burrows in sand at the margins of freshwater, where it is active at dusk and at night. Surveys to support the SSSI condition assessment have only recorded the species on the Dungeness RSPB reserve. As the Royal Military Canal does not feed any of the sewer network within the Dungeness RSPB reserve the species will not be impacted by the drought option.	Screened out of Appropriate Assessment		
	De Folin's lagoon snail *Caecum amoricum*	• Only located in the saline lagoons seaward of Lydd Ranges. As the Royal Military Canal does not supply water to any of the sewer networks within the Dungeness RSPB reserve and adjacent area the species will not be impacted by the drought option.	Screened out of Appropriate Assessment		
5	Regularly supports 34,957 individual waterbirds (non-breeding)	• Not all qualifying species will be impacted by drought permits depending on their habitat and prey preferences. Those listed which could be at risk are; European white fronted goose, gadwall, little grebe, coot and lapwing. • Other commonly occurring species are included such as redshank, dunlin and teal. Those which are reliant on flooded grazing marsh are likely to be impacted by the drought permits. • Reduction in winter flooding of grazing marsh • Decrease in food availability or change in composition. • Failure to meet attributes/targets; supporting habitat: quality of supporting non-breeding habitat (freshwater and coastal grazing marsh)	Updated wintering bird surveys required for those parts of the SPA/Ramsar not already covered by WeBS surveyors of for which the surveys are no longer regularly completed.	Water management protocol See Section 6.8.3.	No
6	Mute swan and shoveler (non-breeding)	Mute swan and shoveler have been recorded in all four WeBS survey sectors, with the highest numbers of mute swan occurring in Walland Marsh and the highest number of shoveler occurring in the Scotney and Lydd West sector. • Reduction in winter flooding of grazing marsh • Decrease in food availability or change in composition. • Increased competition as a result of decreased habitat availability	Updated wintering bird surveys required for those parts of the SPA/Ramsar not already covered by WeBS surveyors of for which the surveys are no longer regularly completed.	Freshwater management protocol, thereby ensuring sufficient water levels See Section 6.8.3.	No

[129] Yates, B. 2012. Rye Harbour Nature Reserve Management Plan 2012-2021. Prepared for the management committee of Rye Harbour Nature Reserve.

Table 6.33 Assessment of adverse effects on Dungeness, Romney Marsh and Rye Bay Ramsar[130]

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK11023			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
Ditches	Habitat functioning: water availability	Characteristic water levels maintained. With the exception of the East Guldeford – Broomhill Levels in the wet ditches summer water depth should be at least 0.5 m in minor ditches and 1 m in major drains. 90% of channel length should reach this target. Satisfactory implementation of Walland Marsh WLMP.	Water levels across the marshes are heavily managed by the Environment Agency, Internal Drainage Board and individual land owners. The ditch system is described in the SSSI citation as being an important example of lowland, slow-moving and eutrophic (nutrient-rich) waters. The Dowels contains the greatest proportion of freshwater ditches on Walland Marsh with the highest plant diversity (sharp-leaved pondweed, greater water parsnip and marsh mallow plant). The areas of Snargate, Fairfield, Woolpack and Cheyne Court contain a less diverse brackish assemblage. The ditches at East Guldeford are less brackish than those in the areas listed above, and where ungrazed margins occur, important stands of marsh mallow occur. Walland Marsh is cited as supporting sharp-leaved pondweed, greater water parsnip, vulnerable divided sedge and rootless duckweed[131]. The drought option will result in a reduction in the amount of water pumped via Iden Lock from the River Rother into the Royal Military Canal and distributed across the wider ditch network. The peak pumping period is between May and July, although pumps can be installed earlier and pumping commenced in April. The summer MRF reduction would be implemented between June and September, whilst the winter MRF will be implemented between October and February. The drought permit/s will result in the following impacts to the pumping regime: • Summer MRF reduction: pumping can occur between April and May and halt once the drought order (DO) is implemented in June. Pumping can recommence in October. Pumping normally ceases in the autumn/winter as the water levels need to be managed to reduce flood risk issues. However, after implementation of the drought permit/s pumping may be required to facilitate the wet grazing marsh required for the overwintering bird populations. A reduction in water to the ditch network is likely to result in the minimum water depth target not being met across a proportion of the system. The Royal Military Canal is less likely to be affected due to its size and position in the network such that it is away from the extremities and closest to the freshwater feed. Similarly, it is considered that the area of The Dowels is less likely to be affected as it is fed directly from the Royal Military Canal and positioned at the head of the system. As discussed in the hydrological assessment, it is considered that the ditch systems fed by the following sewers are likely to be affected, and the sewers themselves could experience a reduction in levels: • Jury's Gut • White Kemp Sewer – Walland Marsh • Guldeford Sewer – East Guldeford Levels • Five Watering Sewer – Fairfield The reduction in the water supply is likely to exacerbate the issues over and above those experienced in a natural drought. Water will pond, with areas becoming isolated, and smaller ditches will dry up altogether. In-channel, emergent and marginal vegetation will be subject to desiccation, particularly those which are	Establish extent of ditch network and likely susceptibility to drying using OS maps and Google Earth in the first instance. Consult with Romney Marsh Area Internal Drainage Board and local Environment Agency contacts to further understand management of water in ditch system. SWS and EA to agree appropriate means of collecting river level data and assessing the volume of water pumped to the Royal Military Canal. Water quality data to also be gathered either through specific monitoring or as part of CSMG structured walks. Complete initial walkover survey of all ditches within the following Ramsar compartments; Jury's Gut, East Guldeford, Walland Marsh (Cheyne Court), Woolpack and Fairfield, to confirm: • Ditch is still present/are new ditches present. • Susceptibility to drying e.g. small shallow ditch at extremity likely to be more at risk of drying than the wider deeper sewers. • Access restrictions to proposed structured walk. • Proposed structured walk routes samples all types of ditch and habitat variations. Complete structured walks following the CSMG guidelines[132] across a sub-sample of ditches.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to conservation objectives and site integrity

[130] Assessment of the GCN qualifying feature is provided under the Dungeness SAC designated site in Table 6.51.
[131] English Nature (2006) Dungeness, Romney Marsh and Rye Bay SSSI, East Sussex and Kent Supporting Information A supplement to the notification package.
[132] JNCC (2005) Common Standards Monitoring Guidance for Ditches.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK11023			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
			shallow rooted and exposed to drying soils. It is difficult to quantify the impacts as there is no data on existing water levels across the ditch network, and these are subject to various levels of control that will change annually to reflect prevailing conditions, and no understanding of the susceptibility of the ditch network to drying out. However, a reduction in water input will adversely affect the supporting processes which the qualifying features rely on, and the structure and function of the ditch habitat itself. Therefore**, we cannot conclude no adverse effect on the feature.**			
Ditches	Habitat functioning: water quality a) water clarity b) extent of algal dominance c) water chemistry	Water clear or only slightly turbid/discoloured in at least 90% of channel length. Mean cover of filamentous macro-algae and *Enteromorpha* < 10% (mid-June to end August) Total phosphorus <0.1 mg L-1; Biological GQA Class 'a' or 'b' depending on reach type. In addition, no drop in class from existing situation. Chemical GQA Class 'A' or 'B' depending on reach type. In addition, no drop in class from existing situation	As the water supply decreases, and movement and flow of water within the system ceases or reduces, there is the potential for increases in nutrient and pollutant concentrations. The 'ponding' of the ditch system could therefore lead to algal blooms and a reduction in dissolved oxygen. There is therefore a risk of a change to water chemistry and an associated increase in filamentous macro-algae and *Enteromorpha*. A reduction in the 'flushing' of the system because of a reduction in flow and movement around the system, could lead to the algal blooms persisting into the autumn. Once water levels do rise, this algae could be displaced and smother marginal and emergent vegetation. The supporting processes and structure and function of the ditch habitat will therefore be adversely affected, although temporarily for the duration of the drought order and any persistence until water levels and flows resume. As such, **we cannot conclude no adverse effect on the feature**.	Establish extent of ditch network and likely susceptibility to drying using OS maps and Google Earth in the first instance. Consult with Romney Marsh Area Internal Drainage Board and local Environment Agency contacts to further understand management of water in ditch system. SWS and EA to agree appropriate means of collecting river level data and assessing the volume of water pumped to the Royal Military Canal. Water quality data to also be gathered either through specific monitoring or as part of CSMG structured walks. Complete initial walkover survey of all ditches within the following Ramsar compartments; Jury's Gut, East Guldeford, Walland Marsh (Cheyne Court), Woolpack and Fairfield, to confirm: • Ditch is still present/are new ditches present. • Susceptibility to drying e.g. small shallow ditch at extremity likely to be more at risk of drying than the wider deeper sewers. • Access restrictions to proposed structured walk. • Proposed structured walk routes samples all types of ditch and habitat variations. Complete structured walks following the CSMG guidelines[133] across a sub-sample of ditches.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to conservation objectives and site integrity
Ditches	Habitat structure: extent/composition of in-channel vegetation	For the majority of the site the mix of early, mid and late succession ditches: • 10-25% early	The drying of the ditches will be disadvantageous to shallow-rooted species or those not adapted to fluctuations in water levels. Exposed soils will be colonised by annuals or those species that can spread rapidly. Given the drought permit/s will only be implemented in severe drought conditions there is the potential for a	Establish extent of ditch network and likely susceptibility to drying using OS maps and Google Earth in the first instance.	Freshwater management protocol between SWS and marsh system, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse	No adverse effects to conservation objectives and site

[133] JNCC (2005) Common Standards Monitoring Guidance for Ditches.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK11023			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
		• 25-75% mid • 10-25% late	shift in community species with in-channel vegetation likely to shift towards emergent vegetation rather than submerged and floating vegetation. As such the structure, composition and distribution of the vegetation communities that contribute to the ditch habitat qualifying feature could be altered, and the target for favourable condition not achieved. If the new communities are resilient to post-drought conditions (including increases in water levels) then this shift will be permanent rather than temporary. Therefore, **we cannot conclude no adverse effect on the feature**.	Consult with Romney Marsh Area Internal Drainage Board and local Environment Agency contacts to further understand management of water in ditch system. SWS and EA to agree appropriate means of collecting river level data and assessing the volume of water pumped to the Royal Military Canal. Water quality data to also be gathered either through specific monitoring or as part of CSMG structured walks. Complete initial walkover survey of all ditches within the following Ramsar compartments; Jury's Gut, East Guldeford, Walland Marsh (Cheyne Court), Woolpack and Fairfield, to confirm: • Ditch is still present/are new ditches present. • Susceptibility to drying e.g. small shallow ditch at extremity likely to be more at risk of drying than the wider deeper sewers. • Access restrictions to proposed structured walk. • Proposed structured walk routes samples all types of ditch and habitat variations. Complete structured walks following the CSMG guidelines[134] across a sub-sample of ditches.	effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3. Other measures may be required to restore the communities that were present pre-drought for example removal of resilient new communities.	integrity
Ditches	Aquatic vegetation composition: native species richness	Freshwater ditches - mean at least 7 species per 20m; Brackish ditches - mean at least 5				
Ditches	Indicators of negative change: cover of non-native plants	Mean cover of each very aggressive non-native plant <1%. Mean total combined cover of all non-native species and introduced species <30%. Separate cover values for *Azolla* spp, *Crassula helmsii*, *Hydrocotyle rannunculoides* and *Myriophyllum aquaticum*.	Many non-native invasive species may exploit drought conditions and impair the re-establishment of native species when water levels return. *Crassula helmsii* for example is tolerant of a range of conditions, including temporal droughts, and grows throughout the year. Other species recorded include water fern and Parrot's feather although are predominately found in ditches located close to built up areas[135]. Himalayan balsam (*Impatiens glandulifera*) may proliferate during drought conditions due to the increase in muddy margins along the ditch edge creating an ideal substrate for seeds to germinate with resulting impacts on characteristic communities. The existing extent of invasive coverage within the impacted ditches is not known and therefore the potential for increasing the spread is uncertain. However, monitoring before and after the implementation of the drought permit/s, with specific management measures put in place for any invasive encountered will avoid adverse effects to the conservation objectives and site integrity.	Establish extent of non-native plant cover during initial walkover survey of ditch network likely to be impacted by drought permit/s.	Undertake targeted clearance and management activities during on-set of drought period along those lengths of ditch identified as containing non-native invasive plants likely to persist or proliferate during drought. Monitor for increases in coverage during drought permit/s implementation and identify requirements for further clearance and management to return to baseline.	No adverse effects to conservation objectives and site integrity

[134] JNCC (2005) Common Standards Monitoring Guidance for Ditches.
[135] Romney Warren Countryside Partnership – non-native alien plants. Accessed at http://www.rmcp.co.uk/non-native-alien-plants/ on 4/04/2019.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK11023			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
Ditches: invertebrates of ditches	Marsh mallow moth *Hydraecia osseola ssp hucherardii*	Marsh mallow present in stands in excess of 400 flowering stems.	Walland Marsh supports one of the two populations of marsh mallow moth in Great Britain, the larvae of which feed on the roots of the marsh-mallow plant. The Walland Marsh population centre comprises three discrete colonies at Moneypenny Farm near Rye, Old Cheyne Court near Brookland, and Woodruff's Farm, Fairfield. Marsh-mallow grows along ditches at Old Cheyne Court, Woodruff's Farm and Moneypenny Farm[136]. The larvae pupate underground attached to the marshmallow root and emerge between May and late July feeding on the stems and roots. Flight season occurs between August and October, with peak period between late August and early September[137]. Therefore, the drying up of ditches, changes in temperature and water quality (nutrient level increases, dissolved oxygen reduction), and shift in plant communities, could lead to a reduction in survival of the larvae and affect the breeding success during the year of the implementation of the drought permit/s. Therefore, **we cannot conclude no adverse effect on the feature**.	As above for ditch feature with recording of marsh mallow stands. Engagement with Butterfly Conservation Group's Kent's Magnificent Moths project which is commencing in 2020.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3. During on-set of drought erect temporary fencing around known stands of marsh mallow to avoid further pressures from grazing. Maintain fencing for a suitable period post-drought. Where possible, water should be targeted to known ditches supporting marsh mallow. Pre-drought, in-drought and post-drought monitoring should be undertaken of identified stands to establish die back and the need for re-seeding/replanting from stock of native provenance where necessary.	No adverse effects to conservation objectives and site integrity
	Marsh mallow - hydrology	Land subject to seasonal inundation by brackish to salt water				
Ditches: water vole	Water vole populations	Ditch network full in the spring, with main drain network and gravel pits holding water throughout the year (the extent of permanent open water on the site needs baseline mapping.) Targets in WLMP met.	The densest and most persistent population of water vole occur between East Guldeford and Jury's Gut, and occur in large numbers at Woolpack, Fairfield and The Dowels. Population numbers fluctuate and range expands and contracts, which is largely attributable to summer water levels in the ditch network. Drought years are accompanied by a collapse in the size of the population with arable ditches impacted the most. However, it is considered that the ditches are re-colonised quickly from ditches that remain flooded in the summer (mostly in grazing marshes)[138]. The water vole mitigation guidelines (2016)[139] summarises the habitat requirements for water vole which includes: • Water depth and likely frequency and height of water level changes – in relation to burrow entrances. • In-channel and bankside herbaceous vegetation type and density – to provide food and cover. • Availability of water as a means of escape – water vole can use watercourses with only a few centimetres of water. A reduction in water levels is likely to expose burrow entrances that were previously underwater. One habitat requirement for water vole is lengths of water which they can use as a means of escape from predators. Dried up sections of ditch and exposed burrow entrances will therefore increase the risk of predation. A reduction in herbaceous vegetation or change in type may affect feeding	Water vole survey – desk study, habitat suitability assessment, and sampling survey to determine water vole presence.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to conservation objectives and site integrity

[136] English Nature (2006) Dungeness, Romney Marsh and Rye Bay SSSI, East Sussex and Kent Supporting Information A supplement to the notification package.
[137] Waring P and Townsend M (2016) Field Guide to the Moths of Great Britain and Ireland: Third Edition
[138] English Nature (2006) Dungeness, Romney Marsh and Rye Bay SSSI, East Sussex and Kent Supporting Information A supplement to the notification package.
[139] Dean M, Strachan R, Gow D, Andrews R (2016) *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series)* Eds. Fiona Mathews and Paul Chanin. The Mammal Society, London.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK11023			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
			patterns and cover from predators. A reduction in water levels or drying up of ditches would therefore result in a depopulation of this area with water vole moving to more optimal habitat. This is likely to increase competition as a result of overlapping territories and a reduction in breeding success, compounded by a likely reduction in suitable food items and an increased risk of predation. As such the population size and range of the qualifying species is likely to contract within the drought year itself and the year after whilst numbers try to re-establish (assuming baseline conditions are restored). Therefore, **we cannot conclude no adverse effect on the feature**.			
Ditches: medicinal leech	Water temperature	Water bodies should contain extensive areas (>50% of margin) of unshaded shallow water with stands of aquatic weed and emergent plants	Medicinal leeches tend to occur in nutrient-rich waters with abundant water plants, and a high proportion of shallow water is also important. This is because shallows warm more rapidly, particularly if water plants are present to reduce circulation and mixing with deeper, colder water. Warm water is important for initiating leech activity, particularly breeding (Nixon, 1998). Dungeness, Romney Marsh and Rye Bay includes a range of shallow, well-vegetated waterbodies that provide ideal conditions for medicinal leeches, including ponds, ditches and shallow areas in flooded gravel pits. Medicinal leeches have been recorded in around 100 waterbodies across the Dungeness, Romney Marsh and Rye Bay area in monitoring programmes completed in 1998/99, 2000-02 and 2005. A key area with the largest number of individuals which could be impacted by a reduction in water levels is East Guldeford Levels[140]. The species requires relatively high temperatures, particularly for breeding and is typically found in shallow water with plenty of submerged and marginal vegetation, where above average water temperatures are maintained in the spring and summer. Although adults are able to avoid desiccation by burrowing into soft mud at the bottom of ditches, the development of eggs and the emerging young could be adversely affected by the drought permit. Therefore, **we cannot conclude no adverse effect on the feature.**	Medicinal leech survey – desk study, habitat suitability assessment and sampling survey to determine medicinal leech presence.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to conservation objectives and site integrity
	Prey availability	Presence of warm blooded prey (birds or mammals) with abundant amphibians or reptiles				
	Pond permanence	Ponds should hold water until at least mid-summer				
Notable vascular plants	Greater water parsnip *Sium latifolium*	Presence/absence – species should be present in units where have been previously recorded	Good populations of greater water parsnip exist on the Royal Military Canal and in many drainage ditches feeding into it. Surveys undertaken (pre-2001) across Romney Marsh showed that 53% of recorded sites were on arable ditches, 26% were ditches on grazing marsh and 19% were ditches running through both arable and pasture land. Grazing marsh ditches generally supported larger colonies of the plant than those on arable land[141]. Greater water parsnip is an emergent plant and requires raised water levels, although is likely to be tolerant of some fluctuation in water levels. As previously discussed it is considered unlikely that the drought order/s will result in any decreases in water levels in the Royal Military Canal and The Dowels, over and above the prevailing drought conditions, as they are at the 'head' of the system and as such would be the last areas to have water diverted, or experience drawdown as a result of reduced pumping. It is unclear whether stands of greater water parsnip occur along the ditch networks supplied by Jury's Gut, White Kemp Sewer (Walland Marsh), Guldeford Sewer (East Guldeford Levels) and Fiver Water Sewer (Fairfield), and therefore whether these could be adversely affected by drying out of ditches, or increased water temperatures and nutrient concentrations in those ditches where water	As above for ditch feature with recording of greater water parsnip stands. Continued consultation with Romney Warren Countryside Partnership to obtain historic data.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3. During on-set of drought erect temporary fencing around known stands of greater water parsnip to avoid further pressures from grazing (hawthorn provides natural deterrent). Maintain fencing for a suitable	No adverse effects to conservation objectives and site integrity

[140] Romney Marsh Countryside Partnership. http://www.rmcp.co.uk/medicinal-leech-uk/. Accessed on 25/03/21.
[141] Romney Marsh Countryside Partnership. http://www.rmcp.co.uk/greater-water-parsnip/. Accessed on 25/03/21.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK11023			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
			levels are reduced. Therefore, **we cannot conclude no adverse effect on the feature**.		period post-drought. Where possible, water should be targeted to known ditches supporting greater water parsnip. Pre-drought, in-drought and post-drought monitoring should be undertaken of identified stands to establish die back and the need for re-seeding/replanting from stock of native provenance where necessary.	
	Sharp-leaved pondweed *Potamogeton acutifolius* and at least six nationally scarce species, including the rootless duckweed *Wolffia arrhiza*.	Presence/absence – species should be present in units where have been previously recorded	A reduction in water levels is likely to lead to some sections of the ditch network drying up completing, cause ponding in other areas, and result in increases in temperature. Water quality will reduce as a result of reduced through-flow and flushing as water is no longer distributed across the network and allowed to recede from the extremities. Increased nutrient concentrations and a reduction in dissolved oxygen are likely to increase the risk of algal blooms. The Ecohydrological Guidelines for Lowland Wetland Plant Communities[142] guidelines classify the Romney marshes ditch vegetation as A3 *Spirodela polyrhiza-Hydrocharis morsus-ranae* community. The trajectories of community change illustrated in the document suggest that eutrophication may cause the duckweed communities to degrade or produce a fennel pondweed community. The literature also suggests that the vegetation is relatively easy to restore, although water quality will need to be optimal and it will be reliant on a viable seedbank being retained during drought. Although only a short-term alteration in the plant community is considered likely as a result of the drought permit/s, the scarcity of the qualifying species suggests that a precautionary approach should be adopted as the habitat may not be easy to restore. Therefore, **we cannot conclude no adverse effect on the feature**.			
	Vulnerable divided sedge *Carex divisa*	No reduction in area and any consequent fragmentation without prior consent Known to be present in units 90, 106, 107, 153 and 156, 8, 10, 13, 15, 38, 44, 61, 94, and 157	A reduction in water levels is likely to lead to some sections of the ditch network drying up completing, cause ponding in other areas, and result in increases in temperature. Water quality will reduce as a result of reduced through-flow and flushing as water is no longer distributed across the network and allowed to recede from the extremities. Increased nutrient concentrations and a reduction in dissolved oxygen are likely to increase the risk of algal blooms. Although only a short-term alteration in the plant community is considered likely as a result of the drought permit/s, the scarcity of the qualifying species suggests that a precautionary approach should be adopted as the habitat may not be easy to restore. Therefore, **we cannot conclude no adverse effect on the feature**.			
	Sea heath *Frankenia laevis*	Species should be present	This species is present on the River Rother. Available information indicates that it is present after the confluence of the River Brede/Tillingham towards Northpoint Beach (TQ936195 and TQ937193)[143]. As discussed in Section 6.8.1 the minor impacts as a result of intermittent flow through Scots Float, will be experienced in the upper estuary, prior to the confluence with River Brede/Tilingham. The saltmarsh present in this canalised section of the River Rother is narrow and consists of low-mid marsh sea purslane community, with some sea couch drift line community present. Give then position of the know areas of sea heath in the lower estuary, no adverse effects are anticipated. However, the absence of sea heath in the upper estuary between Scots Float and the River Brede/Tilingham confluence will need to be confirmed through survey work.	Suitable habitat/NVC survey to confirm sea heath absent from length of River Rother that could be subject to minor hydrological impacts.	None anticipated to be required.	No adverse effects to conservation objectives and site integrity
Invertebrate assemblage (incl. *Donacia* spp.,	Direct Monitoring of assemblage score based on presence/ absence of	Site should meet Threshold Quality Score: W211 Open water on disturbed sediments: core =4	In 2005 (Drake, 2005), invertebrate surveys were carried in four areas of Walland Marsh (Snargate, Fairfield, Cheyne Court and Broomhill Level. These confirmed the earlier conclusions of Drake (2004) as the water beetle fauna of Cheyne Court was found to be outstanding, whilst the area as a whole was considered	As above for ditch feature to establish general condition of ditches and therefore likelihood of supporting a rich invertebrate	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features.	No adverse effects to conservation objectives and site

[142] B.D. Wheeler, D.J.G. Gowing, S.C. Shaw, J.O. Mountford, and R.P. Money, 2004. Ecohydrological Guidelines for Lowland Wetland Plant Communities (Eds. A.W. Brooks, P.V. Jose, and M.I. Whiteman,). Environment Agency (Anglian Region)
[143] Brightmore D (1979) Biological Flora of the British Isle: Frankenia laevis. Journal of Ecology 67, 1097-1107.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK11023			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
Sciomyzidae and Stratiomyidae)	specified proportion of species typical of habitat listed in ISIS.	W314 Rich fen: score =11 W531/M311 Salt marsh and transitional brackish marsh: score =10	exceptionally species-rich for water beetles[144]. Sciomyzidae occupy damp habitats where snails are present providing a suitable food source for their larvae. Some species' larvae are semi-aquatic or aquatic. *Donacia* are widespread on reeds and other emergent marginal vegetation[145] and the larvae, pupae and cocooned adults are all aquatic. Adults will also overwinter inside the submerged part of their food source plant[146]. Similarly, with the soldier-flies likely to inhabit wetland areas, the larvae are aquatic. The Ramsar citation states that a rich water beetle assemblage is associated with the emergent ditch vegetation (comprising common reed *Phragmites australis* and bulrush *Typha latifolia*). It is considered likely that a number of these species will also have aquatic life stages or be reliant on the continued presence of particular food plants to support the population. Therefore, the drying up of ditches, changes in temperature and water quality (nutrient level increases, dissolved oxygen reduction), and shift in plant communities, could lead to a reduction in the breeding success during the year of the implementation of the drought permit/s, and if water levels are not restored in the autumn/winter impact overwintering adults. Therefore, **we cannot conclude no adverse effect on the feature**.	assemblage. Sampling of the ditch network to determine the 'rich water beetle assemblage' will follow survey guidance provided in Natural England's Research Report NERR005 Surveying terrestrial and freshwater invertebrates for conservation evaluation[147] and Buglife's A manual for the survey and evaluation of the aquatic plant and invertebrate assemblages of grazing marsh ditch systems[148]. Further discussion required with Natural England to agree scope, methods and timing of surveys.	A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3. Proactive management of water levels in the marsh drainage system to move water to the most sensitive locations while there is still sufficient water in the system. Installation of local temporary measures in drainage ditches to hold water levels higher (e.g. stop logs)	integrity

Table 6.34 Assessment of adverse effects on Dungeness, Romney Marsh and Rye Bay SPA

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
Bewick's swan (non-breeding)	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at: Freshwater and coastal grazing marsh 849.20 ha; Water column (not quantified).	Bewick's Swans arrive in Britain during mid to late October but do not occur in large numbers until November, building up through December and January. Influxes later in the winter are generally related to hard weather movements or depletion of food reserves on the continent. Spring migration to the breeding grounds normally occurs in February[149]. Water plants and crop leftovers are important food sources for swans refuelling after autumn migration. Winter feeding sites are located in close proximity to permanent waters serving as roost sites[150]. Dungeness Gravel Pits is an important roost site as is Cheyne Court on Walland Marsh. Bewick's swan are recorded as feeding almost exclusively on land between Walland Marsh and Dungeness Gravel Pits. Where aquatic vegetation is present, the birds will feed mostly on the tubers and rhizomes of Potamogeton spp. and Chara spp[150]. The birds will also feed in flooded pastures where they graze on grass and herbs but will also feed	Updated wintering bird surveys would be required of those parts of the SPA/Ramsar not already covered by WeBS surveyors, or for which the surveys are no longer regularly completed.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers	No adverse effects to conservation objectives and site integrity
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g.				

[144] English Nature (2006) Dungeness, Romney Marsh and Rye Bay SSSI, East Sussex and Kent Supporting Information A supplement to the notification package.
[145] http://www.coleoptera.org.uk/family/chrysomelidae
[146] Freshwater Habitats Trust (2015) Creating ponds for the Zircon Reed Beetle Donacia aquatic. Accessed at https://freshwaterhabitats.org.uk/wp-content/uploads/2013/09/Zircon-Reed-Beetle_v2-Feb15.pdf
[147] C.M. Drake, D.A. Lott, K.N.A. Alexander & J. Webb (2007) Natural England Research Report NERR005 Surveying terrestrial and freshwater invertebrates for conservation evaluation.
[148] Palmer M, Drake M, Stewart N (2013) A manual for the survey and evaluation of the aquatic plant and invertebrate assemblages of grazing marsh ditch systems Version 6.
[149] Robinson, JA, K Colhoun, JG McElwaine & EC Rees. 2004. Bewick's Swan *Cygnus columbianus bewickii* (Northwest Europe population) in Britain and Ireland 1960/61 – 1999/2000. Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.
[150] Nagy, S., Petkov, N., Rees, E., Solokha, A., Hilton, G., Beekman, J. and Nolet, B. 2012. International Single Species Action Plan for the Conservation of the Northwest European Population of Bewick's Swan (Cygnus columbianus bewickii). AEWA Technical Series No. 44.Bonn, Germany.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
		Potomageton, Ceratophylum, Zannichellia, Myriophyllum, Chara spp, cereal grains, rape, potatoes, sugar beet, Lolium perenne, Glyceria fluitans, Phleum pratense, Rorippa amphibia, Alopecurus geniculatus and Zostera) at preferred sizes.	on oil seed rape and winter wheat. Implementation of the drought permit/s between June and February will have lowered the water table in the vicinity of the ditch network. It will therefore take longer to fill the system with water again allowing the water table to rise and flood areas of grazing marsh. The drying up of ditches may also have resulted in a loss of the aquatic vegetation the birds feed on when they arrive. A reduction in food availability could result in increased competition and restoration of body mass after the migration flight may take longer to achieve. The drought order/s are likely to exacerbate the effects of the prevailing drought conditions, and prolong the systems recovery, impacting localised winter flooding, as a result of a lowered water table. As such all three attributes could be affected, leading to a potential reduction in overall adult fitness and survival which could impact the next year's breeding success. Therefore, **we cannot conclude no adverse effect on the feature**.		and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. Discussions with farmers to retain crops leftovers on some fields in the vicinity of the roosting areas for longer than normal may be required. See Section 6.8.3.	
	Supporting habitat: hydrology/flow within grassland (improved)	Maintain hydrological processes to ensure water availability in feeding sites, with visible areas of standing shallow water.				
Bittern (non-breeding)	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at: Coastal reedbeds 44.66 ha; Freshwater and coastal grazing marsh 849.20 ha; Coastal lagoons 5.36 ha; Water column (not quantified).	Although the qualifying feature of the SPA is the wintering population of bittern, the impact of the drought permit/s is likely to affect the breeding season and therefore the resident population. In the winter this resident population is increased by the arrival of birds from the continent, with the numbers dependent on the severity of the weather conditions. Bittern are largely restricted to reedbeds during the breeding season. The nest consists of a platform of reed stems amongst standing reeds. Usually four to five eggs are laid in April-May. Research in England originally indicated that males required a reedbed of at least 20 hectares in extent, but it now appears that smaller sites may be utilised provided that other feeding areas are available nearby[151]. Reedbed is highly sensitive to changes in the quantity of water supply, requiring an above surface or near surface water table throughout the year[152]. Therefore, any reduction in water levels could result in the reedbed drying out, with a resultant loss of aquatic species and changes in community composition. Prolonged drying could lead to reedbeds being colonised by species more suited to lower water tables and drier conditions, such as willow. These changes would therefore result in the reedbeds being less favourable for bittern. Priority habitat mapping suggests that there are areas of reedbed on the Lydd Ranges and at Walland Marsh close to Whitehouse Farm and Little Cheyne Court. Anecdotal sightings recorded on the RSPB Dungeness website show use of the reedbeds at the gravel pits in the RSPB reserve by bittern. The wetland bird count data for the Walland Marsh survey site for the last two years of available data (not surveyed since 2010) recorded one bittern in March 2009 and one in March 2010. No bittern were recorded in the Scotney and Lydd West survey site (adjacent to Jury's Gut), or Fairfield or Camber and East Guldeford (data from 2015-2017). On a precautionary basis, the drought permit/s could affect the resident bittern population at Walland Marsh, however updated surveys would be required to determine if the reedbed was still being used as a nest site. The gravel pits on the Dungeness RSPB reserve, and to the north of Dungeness Road will not be impacted by the drought order/s. Therefore, **we cannot conclude no adverse effect on the feature**.	Identify areas of reedbed or other suitable nesting sites (in consultation with NE and RSPB) within the East Guldeford, Walland Marsh, Fairfield and Jury's Gut ditch networks, and obtain relevant baseline data. Breeding bird survey to confirm use of Walland Marsh by bittern.	If bittern are found to be using Walland Marsh, the ditch networks should be managed to maintain the water table height in periods of low flows. This will be achieved by establishing a freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. See Section 6.8.3.	No adverse effects to conservation objectives and site integrity
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. eel, rudd, roach, frogs, toads) at preferred sizes (e.g. roach of 6-35 cm).				
	Supporting habitat: landform	Maintain the extent of wet ditches and/or pools with suitable profiles (typically, with a deep central channel of 1.5-2.5 m deep and one or more 1 m deep with 5 m wide shallow margins).				
	Supporting habitat: water depth	Maintain the overall depth of swamp and marginal water which is typically between 30 – 100 cm, and/or within pools and dykes at typically 200-400 cm deep.				
Golden plover (*Pluvialis apricaria*), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for	The WeBS data records high numbers of golden plover using the Walland Marsh recording unit (2300 individuals in February 2010), 1000's using Rye Harbour and Scotney Court gravel pits in December 2016 with fewer during the early part of 2017, and several hundred using the Fairfield SSSI recording unit (2012) and Camber and East Guldeford (2017). The NBN atlas has records of individuals	Updated wintering bird surveys would be required of those parts of the SPA/Ramsar not already covered by WeBS surveyors, or for which the surveys are no longer	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features.	No adverse effects to the conservation objectives or site integrity

[151] European Union Action Plans for 8 Priority Birds Species – Bittern (1999) Accessed at http://ec.europa.eu/environment/nature/conservation/wildbirds/action_plans/docs/botaurus_stellaris.pdf on 05/04/2019.
[152] Natural England and RSPB (2014) Climate Change Adaptation Manual - Evidence to support nature conservation in a changing climate (NE546):Chapter 13 Reedbeds. Accessed at http://publications.naturalengland.org.uk/publication/5629923804839936

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
	season	all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at: Intertidal rock 109.61 ha; Freshwater and coastal grazing marsh 849.20 ha; Intertidal sand and muddy sand 1183.64 ha; Intertidal coarse sediment 115.77 ha; Spartina swards (Spartinion maritimae) 35.93 ha; Atlantic salt meadows (Glauco-puccinellietalia maritimae) 35.93 ha; Intertidal mud 667.87 ha; Intertidal mixed sediments 81.08 ha; Salicornia and other annuals colonising mud and sand 35.93 ha; Coastal lagoons 5.36 ha; Intertidal seagrass beds (no extent available).	across the Walland Marsh area, the highest number of sightings being in Rye Harbour, on arable land between Five Waters Sewer and Puddledock Sewer (TQ94972518) and at the Scotney Court gravel pits. Implementation of the drought permit/s between June and February will have lowered the water table in the vicinity of the ditch network. It will therefore take longer to fill the system with water again allowing the water table to rise and flood areas of grazing marsh. The drying up of ditches may also have resulted in a loss of the prey items the birds feed on when they arrive. A reduction in food availability will result in increased competition and restoration of body mass after the migration flight will take longer to achieve. The drought permit/s are likely to exacerbate the effects of the prevailing drought conditions, and prolong the systems recovery, impacting localised winter flooding, as a result of a lowered water table. As such all three attributes could be affected, leading to a potential reduction in overall adult fitness and survival which could impact the next year's breeding success. Therefore, **we cannot conclude no adverse effect on the feature**.	regularly completed.	As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. earthworm, leatherjackets, beetles, spiders) at preferred sizes.				
	Supporting habitat: hydrology/flow within grassland (marsh)	Maintain water availability in feeding sites and maintain the area of soggy or flooded land overall.				
Hen harrier (*Circus cyaneus*), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at: Freshwater and coastal grazing marsh 849.20 ha; Intertidal coarse sediment 115.77 ha; Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) 35.93 ha; Intertidal sand and muddy sand 1183.64 ha; Atlantic salt meadows (Glauco-puccinellietalia maritimae) 35.93 ha; Salicornia and other annuals colonising mud and sand 35.93 ha; Coastal reedbeds 44.66 ha; Intertidal	Hen harrier are known to roost in reedbeds across the Walland Marsh area, although will not use the same site each time. Reedbed is highly sensitive to changes in the quantity of water supply, requiring an above surface or near surface water table throughout the year[153]. Therefore, any reduction in water levels during spring and summer could result in the reedbed drying out, with a resultant loss of aquatic species and changes in community composition. This could result in the loss of a roosting site for hen harrier over the winter. The reliance on the ditch network and flooded grazing marshes for feeding is considered lower for hen harrier than other qualifying species given the extensive list of habitats used by the species, and the dietary requirements not consisting of aquatic species. However, given the potential reduction in suitable roosting sites as a result of impacts to reedbed habitat during the spring and summer months, **we cannot conclude no adverse effects on the feature**.	Identify areas of reedbed or other suitable nesting sites (in consultation with NE, RSPB and the Romney Marsh Harrier Recording Group) within the East Guldeford, Walland Marsh, Fairfield and Jury's Gut ditch networks, and obtain relevant baseline data. Where necessary, complete additional surveys to identify use of reedbeds by hen harrier over winter.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to the conservation objectives or site integrity

[153] Natural England and RSPB (2014) Climate Change Adaptation Manual - Evidence to support nature conservation in a changing climate (NE546):Chapter 13 Reedbeds. Accessed at http://publications.naturalengland.org.uk/publication/5629923804839936

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
		mixed sediments 81.08 ha; Intertidal rock 109.61 ha; Spartina swards (Spartinion maritimae) 35.93 ha; Coastal lagoons 5.36 ha.				
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. mammals, birds) at preferred sizes (e.g. pipits to gamebirds; voles to young rabbit size).				
	Supporting habitat: vegetation characteristics for roosting	Maintain an optimal mix of vegetation (flat or gently sloping areas with wet rush, heather, cotton grass, Juncus or other wetland vegetation) in areas used for roosting.				
Ruff (*Calidris pugnax*) non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at: Intertidal sand and muddy sand 1183.64 ha; Freshwater and coastal grazing marsh 849.20 ha; Intertidal mud 667.87 ha; Intertidal mixed sediments 81.08 ha; Atlantic salt meadows (Glauco-puccinellietalia maritimae) 35.93 ha; Salicornia and other annuals colonising mud and sand 35.93 ha; Spartina swards (Spartinion maritimae) 35.93 ha; Intertidal rock 109.61 ha; Intertidal coarse sediment 115.77 ha; Coastal lagoons 5.36 ha.	Ruff (and dunlin) do not feed their young, therefore chicks have to forage as soon as they hatch. Shallow water and muddy areas are therefore essential during spring and summer, in close proximity to nest sites, so that young can find worms, insects and other small animals[154]. Very few ruff were recorded in the WeBS data, with just two individuals recorded in December 2015 in the Camber and East Guldeford recording unit. The NBN Atlas holds no records for ruff in the area. The drought permit/s could directly affect the achievement of maintaining shallow surface water and/or damp field conditions between 1 March and 1 June for nesting and to support chick foraging. The drought permit/s could also reduce the availability of food and/or result in a change in prey composition during the breeding season. A reduction in breeding success or decrease in the condition of individuals during the breeding season could impact the viability of the overwintering population. A reduction in the flooding of grazing marshes over winter could reduce food availability during this period as well. Therefore, **we cannot conclude no adverse effects on the feature**.	Updated wintering bird surveys would be required of those parts of the SPA/Ramsar not already covered by WeBS surveyors, or for which the surveys are no longer regularly completed.	Freshwater management protocol between SWS and marsh system, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to the conservation objectives or site integrity
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. Caddis flies, crustaceans, molluscs, worms dipteran flies, beetles, earthworms) at preferred sizes.				
	Supporting habitat: hydrology/flow within grassland (marsh)	Maintain water availability within nesting areas to provide moderately high water tables that provide shallow surface water and/or damp field conditions between 1 March -				

[154] Danish Forest and Nature Agency West Jutland (2009) Restoration of Meadow Bird Habitats – a LIFE-Nature project. Accessed at http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=laymanReport&fil=LIFE06_NAT_DK_000158_LAYMAN1.pdf

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
		1 June inclusive.				
	Supporting habitat: landform	Maintain shallow slope gradients to the length/perimeter of ditches, drains, pools and scrapes.				
	Supporting habitat: water depth	Maintain the availability of water at optimal depths, typically 1-3 cm deep.				
Marsh harrier (*Circus aeruginosus*), breeding	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at: Freshwater and coastal grazing marsh 849.20 ha; Atlantic salt meadows (Glauco-puccinellietalia maritimae) 35.93 ha; Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) 35.93 ha; Coastal reedbeds 44.66 ha; Intertidal rock 109.62 ha; Spartina swards (Spartinion maritimae) 35.93 ha; Salicornia and other annuals colonising mud and sand 35.93 ha; Intertidal mixed sediments 81.08 ha; Intertidal sand and muddy sand 1183.64 ha; Intertidal coarse sediment 115.77 ha; Coastal lagoons 5.36 ha.	Marsh harrier nests and breeds in wetland habitat, using emergent reed vegetation to construct its nests and evade terrestrial predators. Reedbed is highly sensitive to changes in the quantity of water supply, requiring an above surface or near surface water table throughout the year[155]. Therefore, any reduction in water levels could result in the reedbed drying out, with a resultant loss of aquatic species and changes in community composition. Prolonged drying could lead to reedbeds being colonised by species more suited to lower water tables and drier conditions, such as willow. These changes would therefore result in the reedbeds being less favourable for marsh harrier. Higher water temperatures in the ditches and water quality issues are unlikely to result in a significant change to prey composition and availability (predominantly feed on small mammals and birds). Priority habitat mapping suggests that there are areas of reedbed on the Lydd Ranges and at Walland Marsh close to Whitehouse Farm and Little Cheyne Court. There are no incidental sightings recorded in the WeBS data, however the NBN Atlas has records of marsh harrier across the marsh from East Guldeford to Jury's Gut and north to Fairfield, the latest being recorded in 2015. It is not clear however, whether the reedbeds are being used by breeding marsh harrier, or whether they are just using the area for feeding. Specific surveys would therefore be required to determine use of the reedbeds by marsh harrier during the breeding season. However, the drought permit/s could affect the target of maintaining availability of water across the reedbed area with the majority at a depth of 0.1m-0.3m. Therefore, **we cannot conclude no adverse effects on the feature.**	Identify areas of reedbed or other suitable nesting sites (in consultation with NE, RSPB and the Romney Marsh Harrier Recording Group) within the East Guldeford, Walland Marsh, Fairfield and Jury's Gut ditch networks, and obtain relevant baseline data. Survey areas of reedbed, and known nesting locations, during breeding season to confirm presence of breeding marsh harrier.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to the conservation objectives or site integrity
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. mammals, birds) at preferred sizes (e.g. voles, mice, rabbit; birds of pipit to duck size).				
	Supporting habitat: landscape	Maintain continuous reed cover over large areas avoiding fragmentation of extensive reedbeds.				
	Supporting habitat: water depth	Maintain the availability of water over the entire reedbed area, with a high proportion of the area with a water depth of 0.1 m to 0.3 m.				
Mediterranean gull (*Ichthyaetus melanocephalus*), Breeding	Supporting habitat: extent and distribution of supporting habitat for the breeding	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for	There are few records of Mediterranean gull across the wider Walland Marsh area. The WeBs data only has records for 6 individuals using the Scotney Court gravel pits in April 2017, whilst the NBN Atlas had 42 counts of Mediterranean gull using	Not required.	Not required	No adverse effects to the conservation objectives or site integrity

[155] Natural England and RSPB (2014) Climate Change Adaptation Manual - Evidence to support nature conservation in a changing climate (NE546): Chapter 13 Reedbeds. Accessed at http://publications.naturalengland.org.uk/publication/5629923804839936

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
	season	all necessary stages of its breeding cycle (courtship, nesting, feeding) at Freshwater and coastal grazing marsh 849.20 ha; Intertidal sand and muddy sand 1183.64 ha; Spartina swards (Spartinion maritimae) 35.93 ha; Infralittoral rock 1793.31 ha; Atlantic salt meadows (Glauco-puccinellietalia maritimae) 35.92 ha; Intertidal mud 667.87 ha; Intertidal mixed sediments 81.08 ha; Coastal lagoons 5.36 ha; Water column (not quantified); Intertidal biogenic reef: mussel beds (no extent available); Intertidal stony reef (no extent available).	the area around Fairfield between 2009 and 2015 in the months March-June. Nesting habitat requirements as detailed in the supplementary guidance relate to sward height which will not be affected by the implementation of the drought permit/s, rather than water levels as for some other species. The use of these areas for roosting will also not be impacted by changes in water level. The typical prey species identified in the supplementary guidance are unlikely to be adversely affected by the drought permit/s. Therefore, considering the Mediterranean gull is a predominately coastal feeder, and that nesting and roosting sites are not reliant on water levels, **we conclude no adverse effects on the qualifying feature**.			
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. gobies, earthworm, snails, beetles, lepidoptera, grasshoppers, spider, diperan flies) at preferred sizes.				
Common tern (*Sterna hirundo*) breeding	Breeding population: abundance	Maintain the size of the breeding population at a level which is above 188 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	The nest and roosting areas used by common tern are identified in survey work completed in 2014[156], and will not be impacted by the drought permits. Those at Rye were located close to the coastline at Terney Pool and The Quarry, both within Rye Harbour Nature Reserve. There is no hydrological connectivity between the upper estuary where minor impacts to the salinity gradient, wetted width and flow connectivity of the low tide channel are considered possible. The drought permits could reduce the availability and distribution of fish, which could affect population viability. However, the 2014 survey work did not record the use of the upper estuary as a feeding ground by common tern, and the key prey item present in the estuary, sprat, is considered to be tolerant of a small change in salinity (see 'Supporting habitat: food availability' for further details). As such, no adverse effects are anticipated on the qualifying feature.	Feeding activity observations between Scots Float and confluence of River Rother with River Brede. Suitable methodology, approach and timing to be agreed with Natural England. Fish surveys to be completed on River Rother.	On the basis of current information, common tern do not appear to make use of the upper River Rother estuary for feeding. However, if survey work confirmed use prior to implementation of the drought permits, increasing the frequency of releases from Scots Float may need to be considered.	No adverse effects to the conservation objectives or site integrity
	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at: Freshwater and coastal grazing marsh 849.20 ha; Intertidal sand and muddy sand 1183.63 ha; Atlantic salt meadows (Glauco-puccinellietalia maritimae)	The Walland Marsh area has not been identified as a key feeding, nesting or foraging area used by common tern. Similarly, the upper estuary of the River Rother, between Scots Float and the confluence with the River Brede, and the Royal Military Canal have not been identified as key areas. From information available from the Environment Agency regarding the connectivity of the ditch system and flow of water, the key areas are not hydrologically connected, and therefore are unlikely to be affected by the drought permits. As such, no adverse effects on the qualifying feature are anticipated.	Feeding activity observations between Scots Float and confluence of River Rother with River Brede. Suitable methodology, approach and timing to be agreed with Natural England. Fish surveys to be completed on River Rother.	On the basis of current information, common tern do not appear to make use of the upper River Rother estuary for feeding. However, if survey work confirmed use prior to implementation of the drought permits, increasing the frequency of releases from Scots Float may need to be considered.	No adverse effects to the conservation objectives or site integrity

[156] Yates L (October 2014) A Survey of the Feeding Activity of the Breeding Terns of Rye Bay. Accessed at http://www.seabirdgroup.org.uk/reports/grant-terns-rye-bay-2014.pdf on 19.06.2019.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
		35.92 ha; Intertidal mixed sediments 81.08 ha; Coastal lagoons 5.36 ha; Water column (not quantified).				
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. sandeel, sprat, coarse fish, crustacea, annelids) at preferred sizes.	Sandeels, herring and sprat are important prey for breeding tern, with sandeel preferred for young chicks and herring/sprat for older chicks that can swallow large fish[157]. Survey work completed in 2014 mapped the feeding areas used by the three tern species at Dungeness. Survey locations included the upper parts of the River Rother to Blackwall Bridge, and the Royal Military Canal from Iden Lock, as well as a number of other freshwater pits at Rye Harbour and Dungeness. As a result of the drought permit implementation there could be a reduction in the intermittent freshwater low flows passing through Scots Float into the upper estuary. This could specifically impact upon the salinity gradient, wetted width and flow connectivity of the low tide channel within the upper estuary between Scots Float and the confluence with the River Brede. A potential small reduction in the intermittent freshwater input to the transitional water body will likely result in a small increase to salinity in the upper estuary, which might decrease estuarine productivity and the availability of prey items for euryhaline species. As the salinity gradient alters; decreased freshwater inputs will affect zonation and community structure within the estuary saltmarsh. Reduced freshwater at low tide will decrease the water level in the upper estuary whilst increasing water temperature. Fish will be affected by a reduction in prey items and water quality could be detrimental to the fish population due to changes in dissolved oxygen, ammonia (as DIN) and soluble reactive phosphorus concentrations in the freshwater input to the estuary. Available data (2012) for the estuary recorded the following species; grey mullet species, bass, sprat and goby species. Sprat, one of the key food items for breeding tern, spawn mainly in spring and summer, near to the coast or out to sea. The young drift inshore and enter estuaries and have some tolerance to a reduction in salinity. A reduction of freshwater will not significantly impact this species. The survey work completed in 2014 did not record common tern feeding in the upper estuary, above the A259, or along the Royal Military Canal. The key inland waterbodies used were the Castle Water waterbodies on the Rye Harbour reserve, Northpoint Pit, Scotney Pit, the gravel pits on the RSPB reserve and Greatstone lakes. On the basis that sprat are likely to be resilient to minor salinity changes, and low use of the upper estuary that could be impacted by the drought permits, no adverse effects are anticipated. However, baseline surveys will be completed to verify this assessment.	Feeding activity observations between Scots Float and confluence of River Rother with River Brede. Suitable methodology, approach and timing to be agreed with Natural England. Fish surveys to be completed on River Rother.	On the basis of current information, common tern do not appear to make use of the upper River Rother estuary for feeding. However, if survey work confirmed use prior to implementation of the drought permits, increasing the frequency of releases from Scots Float may need to be considered.	No adverse effects to the conservation objectives or site integrity
	Supporting habitat: water area	Maintain the number of waterbodies of optimal size.	As previously discussed, there is no hydrological connectivity between the River Rother and Walland Marsh ditch system and the waterbodies used for feeding, nesting and roosting by common tern. These are predominantly open waterbodies formed in the old gravel pits; Terney Pool, The Quarry, Castle Water, Northpoint Pit, Scotney Pit, the RSPB reserve and Greatstone lakes. No adverse effects on these waterbodies are anticipated.	None required	None required	No adverse effects to the conservation objectives or site integrity
	Supporting habitat: water quality -	Maintain the dissolved oxygen concentration at levels	As previously discussed, the implementation of the drought permits will cause a reduction in the intermittent freshwater low flows passing through Scots Float to	None required	None required	No adverse effects to the

[157] Purcell A and Nelson K (2018) Rye Small Fish Survey. Sussex Inshore Fisheries Conservation Authority. Available at https://secure.toolkitfiles.co.uk/clients/34087/sitedata/files/Research/Rye-fish-survey-report-2018.pdf. Accessed on 25/03/21.

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
	dissolved oxygen	equating to High Ecological Status (specifically ≥ 5.7 mg L-1 (at 35 salinity) for 95 % of year), avoiding deterioration from existing levels.	the upper estuary. Reduced freshwater at low tide will decrease the water level in the upper estuary whilst increasing water temperature. Fish will be affected by a reduction in prey items and water quality could be detrimental to the fish population due to changes in dissolved oxygen, ammonia (as DIN) and soluble reactive phosphorus concentrations in the freshwater input to the estuary. Risks of water quality deterioration (ammonia, dissolved oxygen and soluble reactive phosphorous) are considered negligible during the implementation of the summer drought permit. There is a negligible risk of deterioration for ammonia, medium risk to dissolved oxygen and a high risk to SRP, with the spring drought permit implementation. The latter is mainly due to the strong seasonality in SRP conditions as well as the general association between elevated SRP levels and low flow conditions. The key prey species favoured during the breeding season, sprat, is unlikely to be found in the upper estuary and minor impacts have been identified to the estuarine fish assemblage as a whole. No adverse effects as a result of temporary deterioration to water quality in the upper estuary are anticipated.			conservation objectives or site integrity
	Supporting habitat: water quality - nutrients	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels.				
Shoveler (*Spatula clypeata*), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at: Freshwater and coastal grazing marsh 849.20 ha; Coastal reedbeds 44.66 ha; Atlantic salt meadows (Glauco-puccinellietalia maritimae) 35.93 ha; Intertidal sand and muddy sand 1183.64 ha; Spartina swards (Spartinion maritimae) 35.93 ha; Intertidal mixed sediments 81.08 ha; Intertidal mud 667.87 ha; Coastal lagoons 5.36 ha; Water column (not quantified).	Shoveler are recorded across the Walland Marsh area with small numbers in the Camber and East Guldeford, Fairfield, and Walland Marsh monitoring units (10s), and large numbers in the Scotney Court gravel pits and Rye Harbour SSSI monitoring units (100s). Implementation of the drought permit/s between March and September will have lowered the water table in the vicinity of the ditch network. It will therefore take longer to fill the system with water again allowing the water table to rise and flood areas of grazing marsh. The drying up of ditches may also have resulted in a loss of the prey items the birds feed on when they arrive. A reduction in food availability will result in increased competition and restoration of body mass after the migration flight will take longer to achieve. The drought order/s are likely to exacerbate the effects of the prevailing drought conditions, and prolong the systems recovery, impacting localised winter flooding, as a result of a lowered water table. As such all three attributes could be affected, leading to a potential reduction in overall adult fitness and survival which could impact the next year's breeding success. Therefore, **we cannot conclude no adverse effect on the feature**.	Updated wintering bird surveys would be required of those parts of the SPA/Ramsar not already covered by WeBS surveyors, or for which the surveys are no longer regularly completed.	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	No adverse effects to the conservation objectives or site integrity
	Supporting habitat: food availability	Maintain the distribution, abundance and availability of key food and prey items (e.g. Scirpus, Eleocharis, Carex, Potamogeton, Glyceria, surface plankton, hatching midges, Hydrobia, crustaceans, caddisflies, diptera, beetles) at preferred sizes				
	Supporting habitat: hydrology/flow within grassland (marsh)	Maintain water availability in feeding sites to provide shallow surface water and damp field conditions.				
Waterbird assemblage (non-breeding)	Supporting habitat: extent and distribution of	Maintain the extent, distribution and availability of suitable habitat (either within	Not all qualifying species will be impacted by the drought permits depending on their habitat and prey preferences. Those listed which could be at risk are; European white fronted goose, gadwall, little grebe, coot and lapwing.	Updated wintering bird surveys would be required of those parts of the SPA/Ramsar not already	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems	No adverse effects to the conservation

DESIGNATED SITE: Dungeness, Romney Marsh and Rye Bay REF: UK9012091			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
	supporting habitat for the non-breeding season	or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding). The extents of supporting habitats for this feature are not currently known.	Other commonly occurring species are included such as redshank, dunlin and teal. Those which are reliant on flooded grazing marsh are likely to be impacted by the drought permits. • Reduction in winter flooding of grazing marsh • Decrease in food availability or change in composition. • Failure to meet attributes/targets; supporting habitat: quality of supporting non-breeding habitat (freshwater and coastal grazing marsh)	covered by WeBS surveyors, or for which the surveys are no longer regularly completed.	to avoid adverse effects to the qualifying features. As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3.	objectives or site integrity
Applicable to all species/ assemblages:	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg L-1 (at 35 salinity) for 95 % of year), avoiding deterioration from existing levels.	No historic water quality data are available for the Walland Marsh ditch system but given the agricultural land use pressures and low velocity and low flow conditions in the watercourses, it is assumed on a precautionary basis that the baseline water quality is relatively poor, particularly in respect of phosphorus, temperature (in hot weather) and dissolved oxygen in the summer months. The risk of deterioration as a result of the drought permit/s is considered to be moderate (uncertain) for ammonia, high (uncertain) for dissolved oxygen and high (uncertain) for soluble reactive phosphorous. Water quality monitoring will be required to establish a suitable baseline for the Royal Military Canal and ditch network. However, a reduction in water and flow (as a result of the management of ditch levels) is likely to lead to the stagnation of water at the extremities, resulting in potential crashes in dissolved oxygen exacerbated by increases in temperatures as a result of reduced depth of water, increases in nutrient concentrations and potential increases in algal blooms. For those bird species reliant on macrophyte and macroinvertebrate prey, changes in water quality could adversely affect the composition and abundance of key prey species, which in turn would adversely affect the condition of individuals, breeding success and could lead to a higher than usual rates of mortality.	Bird surveys as discussed for applicable species/assemblages above. Water quality sampling to be completed as part of ditch assessment (see Table 6.49 for the Ramsar site).	Freshwater management protocol, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. As part of the protocol, the potential for autumn pumping will need to be considered to ensure areas of wet grazing marsh are established for the wintering bird populations. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered.	No adverse effects to the conservation objectives or site integrity
	Supporting habitat: water quality - nutrients	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features, avoiding deterioration from existing levels.				

Table 6.35 Assessment of adverse effects on Dungeness SAC

DESIGNATED SITE: Dungeness SAC **REF:** UK0013059			**PLAN NAME: Southern Water Drought Plan 2022** **OPTION NAME: Darwell**			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
Great crested newt	Supporting metapopulations	Maintain the connectivity of the SAC population to any associated metapopulations (either within or outside of the site boundary)	As previously discussed, there is no hydrological connectivity between the River Rother and Royal Military Canal and the waterbodies on the Lydd Ranges, Lydd Airport, RPSB Reserve and Romney Warren that support the designated metapopulations. There is also no connectivity with the Denge Marsh Sewer and isolated ditches on the Lydd Ranges which may provide additional habitat. However, recruitment from the scattered offsite populations (offsite from SAC but within Ramsar boundaries) could be affected if these individuals use the ditch network. Records of great crested newt are held for Walland Marsh, Rye Harbour, Appledore and Brookland, however it is unclear whether these are for ponds which are likely to be isolated from the ditch network (based on OS map and Google Earth images) and therefore not impacted by the drought permit, or the ditch network itself. If GCN populations occur in some of the ditches, a reduction in water could lead to these areas being cut off during the implementation of the drought permit. Lowering of the water levels and a deterioration in water quality could result in desiccation and stinted development during the egg and larval development phases. The early or increased drying of the ditches may therefore lead to the absence or reduction of a cohort (the collective name for all animals hatched in a single year)[158]. As such, **we cannot conclude no adverse effect on the feature**.	Establish extent of ditch network and likely susceptibility to drying using OS maps and Google Earth in the first instance. Obtain local biological record centre data. Complete initial waterbody scoping visit and Habitat Suitability Index (HSI) assessment. Complete sampling survey for GCN presence/likely absence.	Freshwater management protocol between SWS and marsh system, thereby ensuring sufficient water levels, albeit reduced because of the prevailing drought, are maintained in the ditch systems to avoid adverse effects to the qualifying features. A drought management group comprising SWS, the Environment Agency, Natural England and the Internal Drainage Board would be convened (SWS, EA, NE and IDB) to discuss the objectives of the group and the broad outline of the strategy and necessary triggers and monitoring required. Dissemination of information to relevant landowners, and how the proposal may affect their operations, will also need to be considered. See Section 6.8.3. Installation of local temporary measures in ditches known to support great crested newt to hold water levels higher (e.g. stop logs).	No adverse effects to the conservation objectives or site integrity
Great crested newt	Distribution of supporting habitat	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	As stated in the supplementary advice, *"the particular combination and distribution of aquatic and terrestrial habitats in Dungeness SAC provides breeding, foraging and hibernation conditions for great crested newts"*. The fragmentation of the ditch habitats during the implementation of the drought permits, as a result of increased drying out, could reduce the ability for dispersion of adult and juveniles into suitable terrestrial habitats. This could increase predation, or desiccation of individuals as they are potentially forced to emerge into unsuitable habitat and/or emerge earlier as a result of the earlier drying of the ditch. Therefore, **we cannot conclude no adverse effect on the feature.**			
Great crested newt	Cover of macrophytes	Maintain a high cover of macrophytes, typically between 50-80%, within ponds	Although the drought permits are unlikely to affect macrophyte cover in ponds, being hydrologically isolated, macrophyte cover in the ditch networks could be affected by the drought permits. The drying of the ditches will be disadvantageous to shallow-rooted species or those not adapted to fluctuations in water levels. Exposed soils will be colonised by annuals or those species that can spread rapidly. If the new communities are resilient to post-drought conditions (including increases in water levels) then this shift will be permanent rather than temporary. Marginal and emergent vegetation provide egg laying sites for great crested newt. A shift in the communities present as a result of the implementation of the drought permit could reduce the egg laying opportunities for the year the drought permit is in place, but if the new species are resilient, could result in a loss of an area for egg laying on a permanent basis. Therefore, **we cannot conclude no adverse effect on the feature**.			

[158] English Nature (2001) Great Crested Newt Mitigation Guidelines.

DESIGNATED SITE: Dungeness SAC REF: UK0013059			PLAN NAME: Southern Water Drought Plan 2022 OPTION NAME: Darwell			
Qualifying Feature	**Attribute**	**Target**	**Potential Effects**	**Monitoring**	**Mitigation**	**Effect (on conservation objectives and site integrity)**
Great crested newt	Water quantity and quality	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the feature	The characteristic water levels of the ditch system will not be maintained during implementation of the drought permits. A reduction in water to the ditch network is likely to result in the minimum water depth target not being met across a proportion of the system. The reduction in the water supply is likely to exacerbate the issues over and above those experienced in a natural drought. Water will pond, with areas becoming isolated, and smaller ditches will dry up altogether. In-channel, emergent and marginal vegetation will be subject to desiccation, particularly those which are shallow rooted and exposed to drying soils. As the water supply decreases, and movement and flow of water within the system ceases or reduces, there is the potential for increases in nutrient and pollutant concentrations. The 'ponding' of the ditch system could therefore lead to algal blooms and a reduction in dissolved oxygen. Such conditions are likely to be detrimental to great crested newts and could therefore affect the success of egg and larval development, as well as survival of adults. As such, **we cannot conclude no adverse effect on the feature**.			

Monitoring and Mitigation

Monitoring

As set out above, there are a number of surveys that need to be completed to establish a robust baseline and further determine the likely extent of impacts. Discussions were undertaken with Natural England to agree which elements of the survey work should be undertaken now (e.g. initial assessment if ditches and sampling surveys) and which could be undertaken during the onset of drought to obtain latest information (e.g. breeding bird surveys of reedbeds). The baseline survey work will also need to inform the monitoring requirements for the on-set of drought, during drought and post-drought, and any further mitigation measures that could be used to increase the resilience of the system to drought.

In March 2020 final versions of baseline monitoring plans were submitted to Environment Agency and Natural England and in Spring 2020 baseline monitoring commenced.

Mitigation

Discussions have been held with the Environment Agency and Natural England (November 2018) as to the potential for proactive hydrological management and mitigation during a severe drought in advance of the drought permit implementation to seek to reduce any adverse hydrological effects as identified above. This requires early identification of the potential need for the Drought Order (using Southern Water's drought trigger levels in its Drought Plan) and early discussions on the best way of managing the use of limited freshwater resources, taking account of the time of year and prevailing hydrological conditions in Darwell Reservoir, River Rother, Royal Military Canal and the marsh drainage system.

It is proposed that a drought management group is established at the onset of a drought to begin more proactive hydrological monitoring (including abstraction needs of Southern Water and irrigators on the marshes, as well as environmental needs), as well as to plan for appropriate management and mitigation measures against a range of plausible drought hydrological scenarios for the particular drought event. The drought management group would be comprised of a representative from each of the following organizations that has the authority to make decisions:

- Southern Water
- Environment Agency
- Natural England
- Internal Drainage Board

The Drought Management Group would agree a plan for appropriate hydrological management and mitigation measures and any triggers for their implementation (e.g. water level and/or date triggers). This would particularly include consideration of how best to conserve water levels in the Royal Military Canal and marsh systems (with or without availability of pumping from the River Rother at Iden Lock), balancing environmental needs and irrigation needs. It is proposed that an initial meeting be held to set out the objectives of the management group and identify whether sufficient information is available to confirm the mitigation and likely triggers, and if not, agree what additional work required. In parallel to Southern Water's implementation of water use restrictions, consideration would also be given by the Environment Agency to irrigation restrictions (either by voluntary arrangements or through Section 57 Water Resources Act spray irrigation restrictions. Potential management and mitigation measures to be considered by the Drought Management Group would depend on the time of year that an impending drought is identified and its likely severity, but could include:

- Maximise pumping to Darwell reservoir and to the Royal Military Canal when river flows/levels are high enough (particularly if a dry winter indicates a potential drought the following summer)
- Early consultation with farmers to discuss crop plans (if early enough in the year)
- Proactive management of water levels in the marsh drainage system to move water to the most sensitive locations while there is still sufficient water in the system
- Installation of local temporary measures in drainage ditches to hold water levels higher (e.g. stop logs)
- Voluntary irrigation restrictions
- Reduced or zero abstraction by Southern Water for a short period of time to allow water to be pumped into the Royal Military Canal from Iden Lock (taking account of the prevailing water storage in Darwell reservoir)
- Temporary overland pumping to move water around the drainage system
- Section 57 spray irrigation
- Consider options to enable pumping to continue from Iden Lock at water levels below 0.8mAOD, taking account of statutory navigation duties and in dialogue with navigation stakeholders.

It is proposed that a draft drought management protocol and an agreed set of mitigation options could be further developed jointly by Southern Water and Environment Agency as part of strategic drought planning activities in advance of an actual drought event arising, thereby providing a template from which to work.

The Integrity Test

The integrity of the site is: "*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified*"

Overall, it is considered that there will be no adverse effects arising from the proposed Drought Order on the conservation objectives of the qualifying features of the Dungeness, Romney Marsh and Rye Bay SPA and Ramsar and thus **no adverse effect on site integrity is expected.**

In-combination effects

No in-combination effects with other activities, plans or programmes have been identified.

Conclusions

Based on current level of information regarding the proposed Drought Permit and the assessed impacts upon qualifying features of designated sites discussed above, it is recommended that no further work under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 is required.

It is however recognised that some baseline monitoring surveys have been recommended to further inform the impact assessment for the Drought Permit. The findings from this further work should be used to review the conclusions of this plan-level Appropriate Assessment

which would need to be updated prior to any actual application for a Drought Permit with the new evidence.

6.8 Appropriate Assessment: in-combination effects of Isle of Wight - Lukely Brook, Caul Bourne, Eastern Yar (Blackwater) with Test Surface Water, Lower Itchen Sources and Candover

To address the concerns raised during the draft Drought Plan consultation a further in-combination assessment has been carried out and this section replaces the previous 6.7 Appropriate Assessment: in-combination effects of the Eastern Yar Augmentation Scheme Drought Permit and Lukely Brook WSW Drought Permit and 6.8 Appropriate Assessment: in-combination effects of the Caul Bourne WSW Drought Permit and Eastern Yar Augmentation Scheme Drought Permit.

Potential in-combination LSE's have been considered with operation of the following aspects of the Drought Plan:

- Lukely Brook
- Caul Bourne
- Eastern Yar (Blackwater)
- Test Surface Water
- Lower Itchen sources
- Candover Augmentation Scheme.

The Solent Maritime SAC citation states that there are four included coastal plain estuaries: Yar and Medina on the IOW, and King's Quay Shore and Hamble on the mainland. The citation also refers to four bar-built estuaries: Newtown Harbour on the IOW, and Beaulieu, Langstone Harbour and Chichester Harbour on the mainland. With regards to the mainland features, Langstone Harbour and Chichester Harbour features receive freshwater input from the River Wallington, River Ems, Bosham stream and the River Lavant. The Hamble feature receives freshwater input from the River Hamble, and the Beaulieu feature receives freshwater input from the Beaulieu River.

Three major rivers (on the mainland) provide the bulk of freshwater inputs into Southampton Water: the Test, the Itchen and the Hamble, draining a combined catchment area of a little over 1500 km^2. Other sources that flow into the eastern area of The Solent include the River Meon from the mainland, and the River Medina from the IOW. Webber (1980) calculated that fluvial discharge into Southampton Water comprised only 1.3% of the neap tidal prism[159]. Another study produced to support a conceptual hydrological model of Southampton Water, produced for the EA and DEFRA[160] indicates that the combined freshwater discharge from the Test and the Itchen account for approximately 1% of the tidal flow into and out of Southampton Water.

[159] Webber N. B. (1980), Hydrography and Water Circulation in the Solent, in: The Solent Estuarine System: An Assessment of Present Knowledge, NERC, Publication Series C, No. 22, 25-35.
[160] Ian Townend (Unknown Date), A Conceptual Model of Southampton Water, available at: SOUTHAMPTON WATER (estuary-guide.net), accessed 25th July 2023.

Due to the comparative size of the tidal influence compared to freshwater, the Lower Itchen sources Drought Order (DO) EAR, along with the EAR completed to support the Test Drought Order, both concluded any impacts downstream of the tidal limit (from those respective rivers) to be negligible. As the features located on the IOW are not hydrologically (freshwater) connected to those on the mainland.

It is concluded there is no impact pathway. As a result of this lack of connectivity and consideration of the combined impacts, there is no LSE resulting from the combination of the Lower Itchen sources DO, the Test Surface Water Drought Permit and DO and the Candover Augmentation Scheme DO, with the drought options located on the IOW i.e., Medina, Lukely Brook, Calbourne.

The following sections will assess the in-combination assessment for the Isle of Wight on the European sites screened for LSEs and then assess the in-combination assessment for the mainland Candover, Itchen and Test.

6.9 Appropriate Assessment: in-combination effects of Isle of Wight for Lukely Brook, Caul Bourne and Eastern Yar (Blackwater) drought options

This section is a collation of the 2023 HRA for the above sources.

LSE in-combination restatement
Multiple schemes can affect the same European sites and the potential impacts from the drought options. The 2023 HRAs identified there is potential for Likely Significant Effect of in-combination effects of implementation Lukely Brook, Caul Bourne and Eastern Yar (Blackwater) for the following European sites:

Solent Maritime SAC
Solent and Southampton SPA and Ramsar

Impacts on different parcels of European sites
As concluded in Section 6.7 the European sites features located on the IOW are not hydrological (freshwater) connected to those on the mainland UK. As a result of this lack of connectivity and consideration of the combined impacts, there is no LSE resulting from the combination of the Lower Itchen sources DO, the Test Surface Water Drought Permit and DO and Candover Augmentation scheme DO with drought options located on the IOW (Lukely Brook, Caul Bourne and Blackwater).

Potential impacts from the IOW drought Options

The Lukely Brook Drought Permit (DP) HRA concludes that flow contributions to the Medina Estuary (Solent Maritime SAC and Solent and Southampton SPA and Ramsar) from the Lukely Brook are negligible given the small proportion of flow contributed from the Lukely Brook relative to the freshwater contributions from the River Medina to the Medina Estuary (11 times less flow at Q95.) Additionally, whilst operational the proposed Lukely Brook DP will provide a 0.4 Ml/d compensation flow to the Lukely Brook (to be discharged at Sheep Dip weir), which will theoretically provide higher flows under drought conditions than could be maintained through the normal operation of the existing abstraction licence.

Therefore, it is considered that freshwater flow impacts of the Lukely Brook DP to the Medina Estuary will be avoided, and it can be concluded that the Lukely Brook DP will not have an in-combination effect.

The Caul Bourne DP HRA and Blackwater DP HRA both concluded that provided the identified mitigation measures for both individual DPs are in place, the proposed DP will not have an adverse effect on the EDS when considered alone. These mitigation measures include providing compensation flows to temporarily mitigate the impact of the DP.

With such mitigation measures in place for both Caul Bourne and Blackwater ensuring individually, no adverse effects on the European site, then it is assumed there would be no in-combination effects from the DPs. This conclusion is also valid when assessing in-combination with the remote SWS drought options on the UK mainland and the potential impacts on different parcels of EDSs.

Operation of the drought permit
Whilst it has been concluded that there will be no in-combination effects, providing that the mitigation measures are in place, the operational nature of the DP should be noted again, for context. Should the DP be implemented, any potential impacts arising in the absence of mitigation measures, would be temporary, lasting only for the duration of the DP (maximum 6 months), and would be localised to an area of the upper estuary within the Medina Estuary. It is also currently estimated that the DP would only be implemented, on average, once every 200 years. Therefore a 'lasting effect,' resulting in the permanent loss of a qualifying habitat or species, or the 'long term deterioration' of the habitats or species within the estuary is unlikely.

6.10 Appropriate Assessment: in-combination effects of the Candover, Itchen and Test

Summary
There is concern that changes in groundwater level in chalk aquifer and delayed recovery in river flows after end of drought orders will impact chalk habitat and Southern Damselfly for River Itchen SAC both alone and in-combination. The adverse impact cannot be ruled out as previously described, requiring Stage 3 HRA and Stage 4 as concluded (section 6.2.10)

However, in-combination effects assessments have been undertaken as part of the 2023 HRAs for the Solent European sites.

Solent Maritime SAC
Solent and Southampton Water SPA and Ramsar
Solent and Dorset SPA

The conclusion of the appropriate assessment is that the qualifying features in relation to freshwater inflows and water quality will not be impacted as set out below:

(Candover Drought Order Habitats Regulations Assessment: Stages 1-4 April 2023 draft and Lower Itchen Drought Order Habitats Regulations Assessment: Stages 1-4 April 2023 draft)

The Stage 1 Screening for LSE has identified the requirement for consideration of the in-combination effects of multiple SWS drought permits/orders on the Solent Maritime SAC and

Solent and Southampton Water SPA and Ramsar, along with consideration of the Solent and Dorset SPA.

Solent Maritime SAC: Freshwater input

As reflected in the Supplementary Advice on Conservation Objectives (SACO), only the Solent Maritime SAC has an attribute and target relating to freshwater input for the estuaries feature:

- Structure: freshwater sources - Maintain the natural freshwater flow / volume into the estuary.

The site information does not specifically reference Southampton Water as one of the qualifying estuaries[161], and the information with the SACO specifically cites Chichester and Langstone Harbours, and saltmarsh habitats with regards freshwater input.

Solent Maritime SAC and Solent and Southampton Water SPA/Ramsar: Water quality

Both the Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar have the same two relevant attributes and targets relating to water quality:

- Supporting processes: water quality - dissolved oxygen (habitat) - Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg L-1 (at 35 salinity) for 95 % of year) avoiding deterioration from existing levels.
- Supporting processes: water quality - nutrients (habitat) - Restore water quality to mean winter dissolved inorganic nitrogen levels at which biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features.

Site specific information for the estuaries feature of the Solent Maritime SAC and Solent and Southampton Water SPA, as detailed in the SACO, states that "*The site has been assessed as at risk of eutrophication, using the EA's Weight of Evidence approach*" and "*There is evidence from survey or monitoring that shows this attribute of the feature to be in a poor condition and/or currently impacted by anthropogenic activities*". This is also cited for the mudflats feature, which are found within the lower River Itchen (close to Bitterne), although only designated as part of the Solent and Southampton SPA and Ramsar.

Solent and Dorset Coast SPA: Water quality

The Solent and Dorset Coast SPA has the following attributes and targets relating to water quality:

- Supporting habitat: water quality - dissolved oxygen - Maintain the dissolved oxygen (DO) concentration at levels equating to High Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.
- Supporting habitat: water quality – nutrients - Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features avoiding deterioration from existing levels.

Site specific information for the Solent and Dorset Coast SPA, as detailed in the SACO, suggests that neither DO or nutrients are affecting availability of prey for the tern species. The SACO also states; *"…over 80% of the SPA is in waters assessed as being at low risk of eutrophication using the EA's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive*

[161] NE Conservation Advice for Marine Protected Areas Solent Maritime SAC: Site Information https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0030059&SiteName=Solent+Maritime+SAC&SiteNameDisplay=Solent+Maritime+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=&HasCA=1

opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools"[162].

The SPA is designated to specifically protect essential foraging areas at sea used by qualifying tern species of other nearby SPA/Ramsar sites; common tern *Sterna hirundo* (breeding), little tern *Sternula albifrons* (breeding) and sandwich tern *Thalasseus sandvicensis* (breeding). All three tern species use the open water along the coastline to plunge dive for foraging resources. Water flows/resources are not relevant to ensuring a sufficient fish resource for foraging in this SPA, and the SACO on Conservation Objectives does not include an attribute or target for freshwater input.

Equally, the SACO does not identify eutrophication as a current risk for the species. On the basis of the known breeding sites for the species and foraging ranges[163], the potential impact pathway of a temporary change in water quality in the lower River Itchen is unlikely to act in-combination with those other Drought Permits/Orders within SWS's Drought Plan 2022. As such, no in-combination assessment on the Solent and Dorset Coast SPA is considered necessary.

Solent Maritime SAC: Freshwater Input

Southampton Water, and similarly the mouth of the River Itchen, are not one of the SAC feature estuaries. The Solent Maritime SAC citation states that there are four coastal plain estuaries: Yar and Medina on the Isle of Wight, and King's Quay Shore and Hamble on the mainland. The citation also refers to four bar-built estuaries: Newtown Harbour on the Isle of Wight, and Beaulieu, Langstone Harbour and Chichester Harbour on the mainland. With regards to the mainland features, Langstone Harbour and Chichester Harbour features receive freshwater input from the River Wallington, River Ems, Bosham stream and the River Lavant. The Hamble feature receives freshwater input from the River Hamble, and the Beaulieu feature receives freshwater input from the Beaulieu River. These features do not receive flows from the River Itchen. Features located on the Isle of Wight are not hydrologically connected to those on the mainland.

As the Lower Itchen provides no freshwater input into the estuarine features of the Solent Maritime SAC, there is no impact pathway, and therefore no LSE resulting from the combination of the Lower Itchen drought orders and other SWS drought orders with regards to freshwater volume.

Concerning a potential for in-combination impacts associated with freshwater inputs into Southampton Water, three major rivers provide the bulk of freshwater inputs, the Test, the Itchen and the Hamble, draining a combined catchment area of a little over 1500 km^2. Other sources that flow into the eastern area of The Solent include the River Meon from the mainland, and the River Medina from the Isle of Wight. Webber (1980) calculated that fluvial discharge into Southampton Water comprised only 1.3% of the neap tidal prism[164]. Another study produced to support a conceptual hydrological model of Southampton Water, produced for the EA and DEFRA[165] indicates that the combined freshwater discharge from the Test and the Itchen account for approximately 1% of the tidal flow into and out of Southampton Water. Due to the comparative size of the tidal influence compared to

[162] NE Conservation Advice for Marine Protected Areas Solent and Dorset Coast SPA Designated Sites View (naturalengland.org.uk)
[163] NE (January 2016) Departmental brief: Solent and Dorset Coast potential Special Protection Area (pSPA). Accessed at solent-dorset-departmental-brief.pdf (publishing.service.gov.uk)
[164] Webber N. B. (1980), Hydrography and Water Circulation in the Solent, in: The Solent Estuarine System: An Assessment of Present Knowledge, NERC, Publication Series C, No. 22, 25-35.
[165] Ian Townend (Unknown Date), A Conceptual Model of Southampton Water, SOUTHAMPTON WATER (estuary-guide.net)

freshwater, Appendix B (Hydrology and Physical Environment Assessment) of the EAR completed to support this Drought Order application, along with the EAR completed to support the Test Drought Order, both concluded any impacts downstream of the tidal limit to be negligible. The Environment Agency Review of Consents Appropriate Assessment reaffirms this conclusion. The assessment concluded that the habitats at the mouth of the River Itchen, which form part of the SPA, consist of a small area of mudflat and only a small area of saltmarsh. Given their location, the dominant influence on the maintenance of the habitat was considered to be marine. As such, all abstractions from the River Itchen were concluded as having no adverse effect on the SPA alone or in-combination.

Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar: Water quality

Dissolved inorganic nitrogen (DIN) is comprised of nitrate plus nitrite and ammonium. These forms of nitrogen are readily available to phytoplankton and often control the formation of algal blooms. EA water quality monitoring data were reviewed for all available monitoring locations with appropriate DIN data or, where DIN data were absent, ammonia, nitrate and nitrite data for calculating DIN. All data available between January 2010 – November 2022 were reviewed[166]. The following water quality monitoring locations have been considered for this assessment.

Table 6.34 EA WIMS WQ sampling data locations used for this assessment (2010-2022)

Watercourse	Type	Sample Point Name	Sample Point ID
River Itchen	Freshwater	River Itchen Gaters Mill	SO-G0003786
	Transitional	River Itchen Cobden Bridge	SO-G0003787
		Pickfords Wharf	SO-G0017018
River Test	Freshwater	River Test – Test surface water works	SO-G0003885
	Transitional	Test Estuary 2	SO-G0003873
		Test Estuary 3	SO-G0003869
Southampton Water	Transitional	Approaches Southampton Water-sfw	SO-G0003677
		Southampton Water Hound buoy	SO-G0003562
		Southampton Water-SFY	SO-G0003661
Solent	Transitional	Central Solent	SO-G0003715
		Mother Bank/Osbourne Bay	SO-Y0004278
		Solent Banks	SO-G0003596
		Solent Near East Lepe	SO-G0003590
		Solent Near Horse Sand Buoy	SO-G0003508

To identify the potential DIN contributions from the River Itchen and the River Test into Southampton Water the most downstream freshwater monitoring location was used. For the River Itchen this was the River Itchen Gaters Mill sampling point and for the River Test this was the River Test at Test surface water works sampling point. To determine freshwater DIN contributions from each watercourse, ammonia, nitrate and nitrite were summed. This was then compared against the estuarine monitoring location DIN concentration to identify potential contributions.

Preliminary analysis suggests that the upper reaches of Southampton Water directly receive DIN inputs from the Rivers Test and Itchen. Both watercourses contribute significantly to the

[166] SWS's water quality monitoring data was also reviewed. However, although ammonia was recorded, from a review of the EA data, it is only a small fraction of DIN.

overall DIN load to the upper reaches of Southampton Water, rather than the DIN originating from a coastal source. However, DIN concentrations are considerably higher in the downstream Solent. This suggests DIN is either being transformed and removed from the system by normal processes within Southampton Water or is flushed downstream into the Solent where it has an increased residence time compared to Southampton Water.

The seasonal pattern observed in the data suggests DIN uptake and assimilation is greatest at peak times of the year (spring and summer), and this is to be expected due to temperature and irradiance levels. As the waterbodies become less freshwater and more marine the dominance of the component species of DIN alter to reflect the changes in the gradients of the physical characteristics of estuaries leading to increased variance in DIN environmental fate.

In summary, both the Test and the Itchen contribute significantly to the overall DIN load to Southampton Water and the Itchen Estuary. The drought orders are most likely to be active in the summer months when DIN is typically lower in Itchen Estuary and Southampton Water.

It should be noted that when the Candover Scheme is active, the HOF is maintained into the Lower Itchen downstream of Chickenhall STW at Riverside Park, and as such there is likely to be sufficient flow to ensure continued freshwater flushing of Southampton Water occurs as it typically would and should not significantly impact water quality downstream beyond natural drought conditions. As such, an in-combination effect between the Test and Candover Drought Permits/Orders, in accordance with the s.20 sequencing, is considered unlikely.

It is considered that there may be, temporarily, an increased risk of reduced DIN loads in the Lower Itchen and Southampton Water when the Lower Itchen Drought Orders are operated in-combination with the River Test Drought Order although this risk is highly unlikely to extend into the wider Solent.

Monitoring and Mitigation

As detailed in **Table 6.35** there are a number of specific monitoring and mitigation measures that need to be implemented. In addition, we have updated our environmental monitoring plan (EMP) which is annex 7 to our drought plan.

Details of the proposed baseline survey work were issued to Natural England in February 2019 for agreement, with some work having already been completed during winter 2018-2019 within the optimal survey window (wintering bird surveys). The outline for the mitigation package has been agreed, but discussions are ongoing to establish the specific elements and will be informed by the outstanding baseline survey results. Baseline monitoring is continuing in 2021 and 2022, throughout this period information will be shared with Natural England to help develop mitigation packages.

This proposition takes account of the frequency of Drought Permit implementation (as opposed to application, which could be more frequent) of the Isle of Wight Drought Permits, which (subject to final confirmation) would be no more frequently than **once in every 180-200 years**. In addition, the WRMP19 measures for the Isle of Wight aim to reduce this frequency still further during the second half of the 2020s.

Conclusions

Overall, it is considered that there will be no adverse effects arising from the two proposed Drought Permits being implemented concurrently on the conservation objectives of the qualifying features of the European sites and thus **no adverse in-combination effect on site integrity of any European site is expected.**

Table 6.35 Potential Combined Impact of Caul Bourne and Eastern Yar

Potential Effect	Significance	Specific Monitoring and Mitigation Measures	Residual Effect after Mitigation
Solent Maritime SAC			
Habitat degradation - exposure	Mudflats A total area of 78ha of mudflats could be at risk of increased exposure if all Drought Permits were to operate together. This is approximately 1.5% of the total mudflats area (5,059.4ha) identified in the SAC citation[167].	Monitoring The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and the Environment Agency): • Flow, velocity and wetted area measurements at selected locations within Shalfleet Creek and the Medina estuary. • Walkover survey of both Shalfleet Creek and Medina Estuary to assess the level of low tide hydrological features and connectivity with the habitats (mudflats/sandflats). • Habitat mapping of mudflats and connectivity with channel at low tide.	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.
	Saltmarsh In-combination impacts unlikely as no adverse impacts to the saltmarsh along the Medina Estuary have been identified due to the lack of hydrological connectivity with the channel at low flow.	None required.	
Habitat degradation – water quality	*Nutrient Dilution and Flushing* Although the water quality risks for all options has been assessed as low, increases in macroalgae in both estuary systems during, or a prolonged recovery time, would potentially result in a change to '*the structure and function (including typical species) of the qualifying natural habitats'.* This potential temporary change in the abundance and diversity of the mudflat invertebrate community is unlikely to cause long term changes to the structure and function to the habitat, as typical assemblages are likely to return once normal flows are reinstated after the Drought Order, however the shift in	Monitoring The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and the Environment Agency): • DAIN monitoring in upper Medina Estuary (upstream of ~Wippingham) and Shalfleet Creek. • Additional water quality monitoring for soluble reactive phosphorous (SRP),	No adverse effect to the SAC integrity and the ability to meet the favourable conservation status will not be impeded.

[167] http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0030059.pdf

	communities could impact the qualifying features of the SPA and Ramsar which the mudflats support.	dissolved oxygen, salinity, temperature and conductivity. <u>Mitigation</u> • Continued compliance with nitrogen stripping at Peel Common STW. • Continued engagement in catchment management schemes to reduce nitrogen loading across the catchment area. • Consider other specific measures that can be implemented in Medina catchment to reduce nitrogen and/or phosphorous.	
Solent and Southampton Water SPA			
Changes in prey/food resource abundance and prey species dominance as a result of reductions in freshwater flow of the estuary.	Ringed plover and black tailed godwit – feeding	<u>Monitoring</u> The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and the Environment Agency): • Wintering bird surveys to determine use of Shalfleet Creek and upper Medina Estuary by ringed plover and black tailed godwit. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in Shalfleet Creek. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer to establish area of mudflats impacted in Shalfleet Creek and upper Medina Estuary and therefore may have a prolonged recovery time when birds feed during winter	No adverse effect to the SPA integrity and the ability to meet the favourable conservation status will not be impeded.
Solent and Southampton Water Ramsar			

Changes in abundance and distribution as a result of reductions in freshwater flow of the estuary.	Important assemblage of rare plants and invertebrates. At least 33 BRDB invertebrates and at least eight BRDB Book plants are represented on site. Invertebrates: • *Allomelita pellucida, Gammarus insensibilis Nematostella vectensis, Arctosa fulvolineata, Aulonia albimana, Anthonomus rufus, Baris analis, Cantharis fusca, Drypta dentata, Leptura fulva, Meligethes bidentatus, Staphylinus caesareus, Aphrosylus mitis, Dorycera graminum, Haematopoda grandis, Hippobosca equina, Linnaemya comta, Stratiomys longicornis, Syntormon mikii, Tetanocera freyi, Villa circumdata, Trachysphaera lobata, Paludinella littorina, Truncatellina cylindrica, Andrena alfkenella, Elachista littoricola, Melissoblaptes zelleri, Platytes alpinella, Psamathrocrita argentella, Armandia cirrhosa.* Unlikely to be impacted by the Drought Order but presence in Shalfleet Creek needs to be confirmed through survey. • *Anisodactylus poeciloides, Berosus spinosus, Paracymus aeneus, Atylotus latistriatus, Acleris lorguiniana* Potential to be impacted by the Drought Order but presence in Shalfleet Creek needs to be confirmed through survey. Plants: *Eleocharis parvula, Geranium purpureum forsteri, Lotus angustissimus, Ludwigia palustris, Orobanche purpurea, Lamprothamnium papulosum, Spartina maritima Zostera marina*	The following monitoring needs to be undertaken to inform an assessment as no data is currently available, and following this a specific mitigation package (locations and methods to be agreed with Natural England and the Environment Agency): • Invertebrate surveys at sampling points in Shalfleet Creek and upper Medina Estuary to confirm presence, distribution and abundance. Invertebrate surveys at sampling points in Shalfleet Creek and upper Medina Estuary to confirm presence, distribution and abundance. Vegetation surveys in Shalfleet Creek and upper Medina Estuary to confirm presence, and map distribution and abundance.	No adverse effect to the Ramsar integrity and the ability to meet the favourable conservation status will not be impeded.
Changes in abundance and distribution as a result of reductions in freshwater flow of the estuary.	Little egret (peak count spring/autumn) The coastal diet of this species is identical to other heron species and includes fish fry, crustaceans and amphibians. As the species is not reliant on mudflat benthic invertebrates, there will be no adverse effect on the foraging success of the population. Spotted and common redshank (peak count spring/autumn and winter respectively) Wading birds attracted to Shalfleet Creek at low water are likely to include significant numbers of redshank and are known to feed on the intertidal mudflats[168]. Although total and peak count information provided by WeBS indicates that Shalfleet Creek is generally of low value to the overwintering bird	None required The following monitoring needs to be undertaken to inform any specific mitigation package (locations and methods to be agreed with Natural England and the Environment Agency):	No adverse effect to the Ramsar site integrity and the ability to meet the favourable conservation status will not be impeded.

168 Environment Agency (2005) Review of Consents, Part B Functional Assessments: Water Resources Appropriate Assessment Solent & Southampton Water SPA.

	assemblage associated with the Ramsar, with no spotted redshank recorded, an increase in extent of algal blooms, or increased persistence into the autumn changing the benthic invertebrate communities could result in a change in the feeding patterns for these species.	• Bird surveys to confirm numbers of redshank species using Shalfleet Creek and the upper Medina Estuary. • Baseline estuarine macroinvertebrate and wider macrofauna survey at low tide should also be carried out in summer and winter to establish location, composition, abundance and condition of the mudflat habitat communities present in the upper Medina Estuary. This can be linked to the prey requirements of the qualifying bird species. • Macroalgae surveys in summer and winter to establish area of mudflats impacted.
	Water rail (peak count in winter) This species will not be affected by changes in invertebrate communities on the mudflats as it is an inhabitant of wetlands	None required.

6.11 Stage 2 Appropriate Assessment conclusions

The Stage 2 Appropriate Assessments initially concluded that there were two drought plan measures – the Candover Augmentation Scheme Drought Order and the Lower Itchen Sources Drought Order – where adverse effects on a European site cannot be ruled out, adopting a precautionary approach.

Both Drought Orders were therefore taken forward to Stage 3 (Assessment of Alternatives) of the Habitats Regulations Assessment process as discussed in Part C of this HRA report.

In addition, the July 2024 project level HRA Appropriate Assessment (AA) for the River Test Drought Permit concluded that there was no likely significant effect for all European sites except for the River Itchen SAC. It found that for "*the River Itchen SAC, the assessment concludes that adverse effect on integrity cannot be excluded with certainty, at this juncture, with the various mitigation measures, as proposed. Further discussion with the EA on the mitigation measures is welcomed to progress this assessment*."

These ongoing discussions with regulators relating to the River Test surface water drought permit project level HRA indicated that the EA did not consider the mitigation proposed to be sufficient to prevent any potential adverse effects. Adopting the precautionary principle in relation to what may be functionally linked habitat, we have decided that this project level HRA will now progress to stage 3 and, if required, stage 4 of the HRA process. We wrote to the EA on 21 November 2024 to confirm this decision. This is part of the 'application ready' principles that we adhere to should such a drought option be needed in the future.

This process will need to be finalised before any River Test Drought Permit can be granted and implemented. We are currently expecting to conclude this process by summer 2025 and set out an indicative timeline for the process in table 4-7 of the main drought plan report. We shared this indicative timeline with the EA in December 2024. We will update the EA on the latest position with the project level HRA via the annual review process however we do not expect this ongoing process with the project level HRA to impact upon the finalisation of this drought plan.