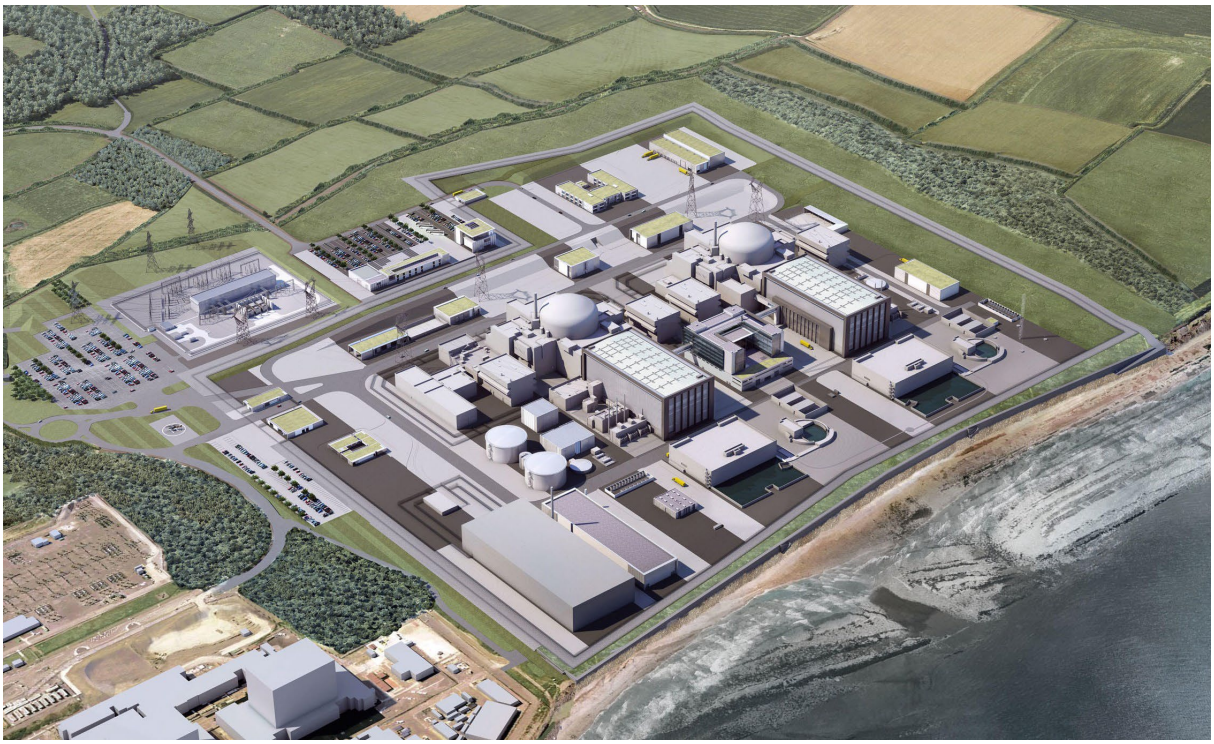

Habitats Regulations Assessment

HPC operational water discharge activity permit variation, EPR/HP3228XT/V005

Date: June 2023

Version: 2

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Contents

1. Foreword

NNB Generation Company (HPC) Limited (NNB GenCo) are constructing a new nuclear power station at Hinkley Point in Somerset, known as Hinkley Point C (HPC).

The construction and operation of HPC requires various permissions from the Environment Agency (EA), Department for Energy Security and Net Zero, and the Marine Management Organisation (MMO) amongst others.

Permissions for the building and operation of the power station were granted in 2013. These included a Development Consent Order (DCO), a water discharge activity (WDA) permit, and a marine licence (ML).

We have received an application to vary the operational water discharge activity (WDA) permit, to remove conditions that relate to an acoustic fish deterrent (AFD) and add a waste stream for discharge from the fish recovery and return system (FRR).

A similar application was made in 2019, however this was deemed to be refused by the applicant in 2020, before our assessment had concluded. This was then appealed by the applicant in 2020, which the Secretary of State dismissed in 2022.

The cooling system is considered by three regulators with different regulatory powers – Environment Agency in relation to the water discharge activity permit, Secretary of State for Energy Security and Net Zero (formerly Business, Energy and Industrial Strategy) in relation to the Development Consent Order and Marine Management Organisation in relation to the marine licence.

The original WDA permit application (submitted in 2011) included three mitigation measures in the design of the cooling water system: an acoustic fish deterrent, low velocity side intakes and a fish recovery and return system. The existing permit, issued in 2013, allows the cooling water system to operate as described in the application. The condition requires the applicant to submit reports to the Environment Agency describing how their proposed AFD will operate and demonstrate that it will be optimised to minimise impacts on fish. These conditions are now requested for removal as the applicant no longer wishes to put the AFD in place as part of the variation application.

There is a duplication of a similar requirement in the Development Consent Order (DCO) regarding AFD optimisation which has led to a potential overlap of regulation across the planning and permitting regimes, with the same requirements in all 3 permissions granted for the station. In consultation with Natural England and the Marine Management Organisation we have concluded that the most appropriate mechanism for regulating the cooling water intake sits with the DCO regime and within the DCO, as the DCO considers the impacts of the effects of the cooling system in its entirety including the intake.

The Environment Agency’s powers in relation to water discharge activities (WDA) under the Environmental Permitting Regulations 2016 allow us to consider the cooling water system, as it relates to the potential for pollution of waters via the discharge. We consider

that dead or damaged fish are potential polluting matter, so we have assessed the proposed removal of the AFD on that basis.

The Environment Agency, as a Competent Authority, is required, under the Conservation of Habitats and Species Regulations 2017 (as amended) (Habitats Regulations), to undertake a Habitats Regulations assessment (HRA) for any permissions it grants that have the potential to impact upon European designated sites.

These include Special Areas of Conservation (SACs and candidate SACs), which are designated under the Habitats Regulations for important high quality habitat sites, and Special Protection Areas (SPAs and potential SPAs), also designated under the Habitats Regulations, classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species.

Ramsar sites are wetlands of international importance designated under the Ramsar Convention and Government policy gives Ramsar sites broad equivalence to those designated under the Habitats Regulations. Therefore, Ramsar sites will be included within the assessment.

Collectively, these types of sites are known as European sites.

The purpose of this assessment is to ascertain, in view of the conservation objectives of the European sites, whether it can be concluded that the variation to the permit will not adversely affect the integrity of the sites in question, either alone or in combination with other relevant permissions, plans, or projects.

We will assess the polluting impact of removing the requirement for an AFD on European Sites from the fish recovery and return system outfall.

What follows in this document is a record of the Habitats Regulations Assessment required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) (SI No. 2017/1012) we have carried out.

2. Executive summary

We have carried out a Habitats Regulations assessment (HRA) for the variation to the operation water discharge activity permit for Hinkley Point C (HPC).

The HRA assesses the potential impact of our permissions on achieving the conservation objectives for the following European sites, as listed in section 5 of this assessment.

The main areas of potential concern we focused on included toxic contamination, nutrient enrichment, smothering and associated habitat loss. These hazards have been assessed in respect of the project itself; and in respect of the combined impact of the project with other permissions, plans or projects in the area.

The following conclusions reflect our findings for the sites listed in section 5, Relevant European sites.

The results of the screening stage are provided in Appendix 3 of this HRA (Environment Agency (2023c; Appendix 3).

We have concluded that there was no adverse effect on the integrity of all the sites considered in this assessment for the variation to the operational WDA permit for HPC either alone or in combination with other permissions, plans or projects.

3. Introduction

Hinkley Point C (HPC) station will consist of two United Kingdom European pressurised reactors (UK EPR), based on the European pressurised reactor (EPR™) design. We are required, under the Conservation of Habitats and Species Regulations 2017 (as amended), to undertake a habitats regulations assessment (HRA) for any permissions we grant relating to the construction, commissioning and operation of HPC that has the potential to affect European designated sites.

The UK EPR is a single, pressurised water reactor capable of generating in total 1735 megawatts (MW) of electricity and providing 1630MW of this to the national grid. In the reactor core, the uranium oxide fuel is cooled by water in a pressurised circuit, the primary circuit. The primary circuit includes four steam generators where heat is transferred from the primary circuit to an isolated secondary circuit, producing steam. This steam then drives a turbine-generator to produce electricity, is condensed by a condenser system and the condensate returned to the steam generators. At HPC the condenser will be directly cooled by sea water. The proposed direct cooling system will continuously abstract large volumes of water from the Bristol Channel and return this water to source once utilised within the plant.

The original WDA permit application (submitted in 2011) included three mitigation measures in the design of the cooling water system: an acoustic fish deterrent, low velocity side intakes and a fish recovery and return system. The existing permit, issued in 2013, allows the cooling water system to operate as described in the application. The condition requires the applicant to submit reports to us describing how their proposed AFD will operate and demonstrate that it will be optimised to minimise impacts on fish. These conditions are now requested for removal as part of the variation applicant no longer wishes to put the AFD in place.

The purpose of our assessment is to decide, in view of the conservation objectives of the European sites, whether it can be concluded that the variation to the permit will not adversely affect the integrity of the relevant European sites (refer to section 5), either alone or in combination with other relevant permissions, plans, or projects.

The methodology and assessment for the FRR system outlet discharge references the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 assessment (WFD) completed for the permit variation as the best available information.

4. Requirements for a Habitats Regulations assessment

4.1. The regulatory position

The requirement for a competent authority to carry out an appropriate assessment (referred to as 'AA') is set out in Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) (known as 'the Habitats Regulations') which transposed the requirements of Article 6(3) Habitats Directive and provides:

63.— Assessment of implications for European sites and European offshore marine sites

(1) A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which—

(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 that site,

must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives.

(2) A person applying for any such consent, permission or other authorisation must provide such information as the competent authority may reasonably require for the purposes of the assessment or to enable it to determine whether an appropriate assessment is required.

(3) The competent 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.

(4) It 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.

(5) In the light of the conclusions of the assessment, and subject to regulation 64, the competent authority may agree to the plan or project 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).

(6) In considering whether a plan or project will adversely affect the integrity of the site, the competent authority must have regard to the manner in which it is proposed to be

carried out or to any conditions or restrictions subject to which it proposes that the consent, permission or other authorisation should be given.

European sites are any that would be included within the definition given in regulation 8 of the Conservation of Habitats and Species Regulations 2017 (as amended) and include:

- Special Areas of Conservation (SACs)
- candidate Special Areas of Conservation (cSACs)
- Sites of National Importance (SNIs)
- Special Protection Areas (SPAs)

European sites also include those given the same protection as a matter of government policy, such as:

- potential Special Protection Areas (pSPAs)
- possible Special Areas of Conservation (pSAC)
- listed or proposed Ramsar sites
- sites identified, or required, as compensatory measures for adverse effects on European sites, pSPAs, pSACs and listed or proposed Ramsar sites

The Conservation of Offshore Marine Habitats and Species Regulations 2017 implements the requirements of the Habitats and Birds Directives offshore. It ensures the protection of species that are found more than 12 nautical miles from the coast, and some SPA sites are designated under these Regulations.

European Marine Sites (EMS) collectively refer to marine sites of both SACs and SPAs that protect some of our most valuable marine and coastal species and habitats. They are not statutory designations but act as a management unit.

The purpose of this assessment therefore is to ascertain, in view of the conservation objectives of the identified European sites, whether it can be concluded that the variation applied for will not adversely affect the integrity of the European sites in question, either alone or in combination with other relevant permissions, plans or projects (PPP).

The information within this assessment is based on the best available information at the time. Any information presented to us outside of the assessment timeframe may not be considered.

This is a record of the Habitats Regulations assessment required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) (SI No. 2017/1012) we have carried out.

The requirements of the Habitats Regulations still apply post EU exit, and we must continue to fulfil those requirements when carrying out our role as a competent authority. Confirmation that the Habitats Regulations still apply and an explanation of the changes made to them by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 are provided in policy paper ‘Changes to the Habitats Regulations 2017’ (Defra, 2017) which can be viewed here.

4.2. Guidance on completing an appropriate assessment

This section provides a summary of the guidance that has been considered when concluding the HRA for the permit variation.

'Habitats regulations assessments: protecting a European site' produced by Defra, Natural England, Welsh Government and Natural Resources Wales, 2021.

This document (available here) provides guidance on how we, as a competent authority, must decide if a plan or project proposal that affects a European site can go ahead. It applies to European sites in England and Wales and their inshore waters (within 12 nautical miles of the coast).

The guidance confirms the need to apply the 'precautionary principle' at each stage of the HRA process, stating that "if you cannot rule out all reasonable scientific doubt of an adverse effect on a site's integrity at stage 2: appropriate assessment, you must refuse the proposal unless an exemption (stage 3: derogation) is justified."

When carrying out an appropriate assessment and 'integrity test', the guidance recommends that the following considerations should be made:

- the ecological requirements, conservation objectives and the current conservation status (if known) of the site's designated features that might be affected by the proposal
- each potential effect on the European site, including the risk of combined effects with other proposals, and how they might impact on the site's conservation objectives
- the scale, extent, timing, duration, reversibility and likelihood of the potential effects
- how certain you are of the effects occurring
- mitigation measures that have been proposed or conditions you can attach to avoid or limit the effects
- how confident you can be that mitigation measures will be effective over the whole lifetime of the proposal

This guidance concludes that "a proposal will pass the integrity test if your appropriate assessment can show that there is no reasonable scientific doubt that the proposal will not have an adverse effect on the integrity of the site." It is only if this conclusion is reached that the permission can be granted.

'Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. (2019/C 33/01)'

This document (available here) provides guidelines to the European Union member states on the interpretation of certain main concepts used in Article 6 of the Habitats Directive and states "it is however expected to also facilitate the understanding of the mechanics of the Habitats Directive amongst anyone involved in the management of Natura 2000 sites and in the Article 6 permit procedure."

In carrying out an HRA, the principles as set out in section 4.6 (‘What is meant by ‘appropriate assessment of its implications for the site in view of the site’s conservation objectives’?’) and section 4.7 (‘Decision making’), must be applied.

Section 4.6.2 confirms that an appropriate assessment should be based on the “best available scientific knowledge in the field”, that the “information required should be up-to-date” and that it “should apply the best available techniques and methods to assess the extent of the effects…on the integrity of the site(s).” The issues that could be considered in an AA, are presented as follows:

- structure and function, and the respective role of the site’s ecological assets
- the area, representativity and degree of conservation of the habitat types on the site
- population size, degree of isolation, ecotype, genetic pool, age class structure, and degree of conservation of species under Annex II to the Habitats Directive present on the site
- any other ecological assets and functions identified on the site
- any threats affecting or representing a potential risk to species present on the site

The guidance confirms that when concluding an AA any effects from the proposal must be assessed against the site’s conservation objectives [4.6.3] and that ‘site integrity’ relates to these objectives [4.6.4]. When considering site integrity, “if none of the habitat types or species for which the site has been designated is significantly affected then the site’s integrity cannot be considered to be adversely affected. However, if just one of them is significantly affected, taking into account the site’s conservation objectives, then the site integrity is necessarily adversely affected.”

Section 4.6.4 concludes with “the integrity of the site involves its constitutive characteristics and ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the habitats and species for which the site has been designated and the site’s conservation objectives.”

Guidance is provided on the focus of the assessment within section 4.6.5, which states that “it is evident that the effects of each project will be unique and must be evaluated on a case-by-case basis” and “the appraisal of effects must be based on objective and, if possible, quantifiable criteria.”

Section 4.7 clearly states that the Environment Agency, as a competent authority, can only issue a permit “after they have made certain that the plan or project will not adversely affect the integrity of the site. That is the case where no reasonable scientific doubt remains as to the absence of such effects.” The section concludes with “the onus is therefore on demonstrating the absence of adverse effects rather than their presence, reflecting the precautionary principle. It follows that the appropriate assessment must be sufficiently detailed and reasoned to demonstrate the absence of adverse effects, in light of the best scientific knowledge in the field.”

Use of supplementary advice packages

The following advice is given in the NE Designated Sites View webpage:

"The Supplementary Advice on Conservation Objectives (SACOs) presents attributes which are ecological characteristics or requirements of the classified species within a site. The listed attributes are considered to be those which best describe the site's ecological integrity and which if safeguarded will enable achievement of the Conservation Objectives.

You should use this information, along with the conservation objectives and case-specific advice issued by Natural England when developing, proposing or assessing an activity, plan or project that may affect the site.

Any proposals or operations which may affect the site or its features should be designed so they do not adversely affect any of the attributes in the SACO or achievement of the conservation objectives."

SACOs have not been published for the Severn Estuary SAC and SPA yet. We have referred to the advice given under the Regulation 33(2)(a) of the Habitats Regulations written by Natural England and the Countryside Council for Wales (Natural England and CCW, 2009). This advice includes favourable condition tables which provide a similar information as the SACOs.

4.3. Habitats Regulations assessment considerations and case law

Regulation 63 of the Habitats Regulations defines the procedure for the assessment of the implications of permission, plans, or projects (PPP) on European sites. The steps taken when carrying out a Habitats Regulations assessment, or HRA are summarised below.

4.3.1. Is an HRA required?

A course screening exercise must be carried out to identify European sites within relevant screening distances or zones of influence.

4.3.2. Screening for significant effects

A project is 'likely to have a significant effect' so as to require an appropriate assessment if there is a real risk of a likely significant effect occurring, that is, the risk of it occurring cannot be excluded on the basis of objective information: Landelijke Vereniging tot Behoud van de Waddenzee and Another v Staatssecretaris van Landbouw [2004] E.C.R. I-7405 ('Waddenzee'), at [44].

In regard to what can be considered when deciding whether a plan or project is likely to have a significant effect on a European site, further clarification is provided in Peter Sweetman v. Coillte Teoranta (2018), Case C-323/17 ('People over Wind'). The judgement states that "measures intended to avoid or reduce … harmful effects" (typically referred to as 'mitigation measures') cannot be considered when deciding whether or not a plan or project is likely to have a significant effect on a European site. Competent authorities must

instead take account of measures intended to avoid or reduce the harmful effects of a plan or project as part of the appropriate assessment.

4.3.3. In-combination assessment

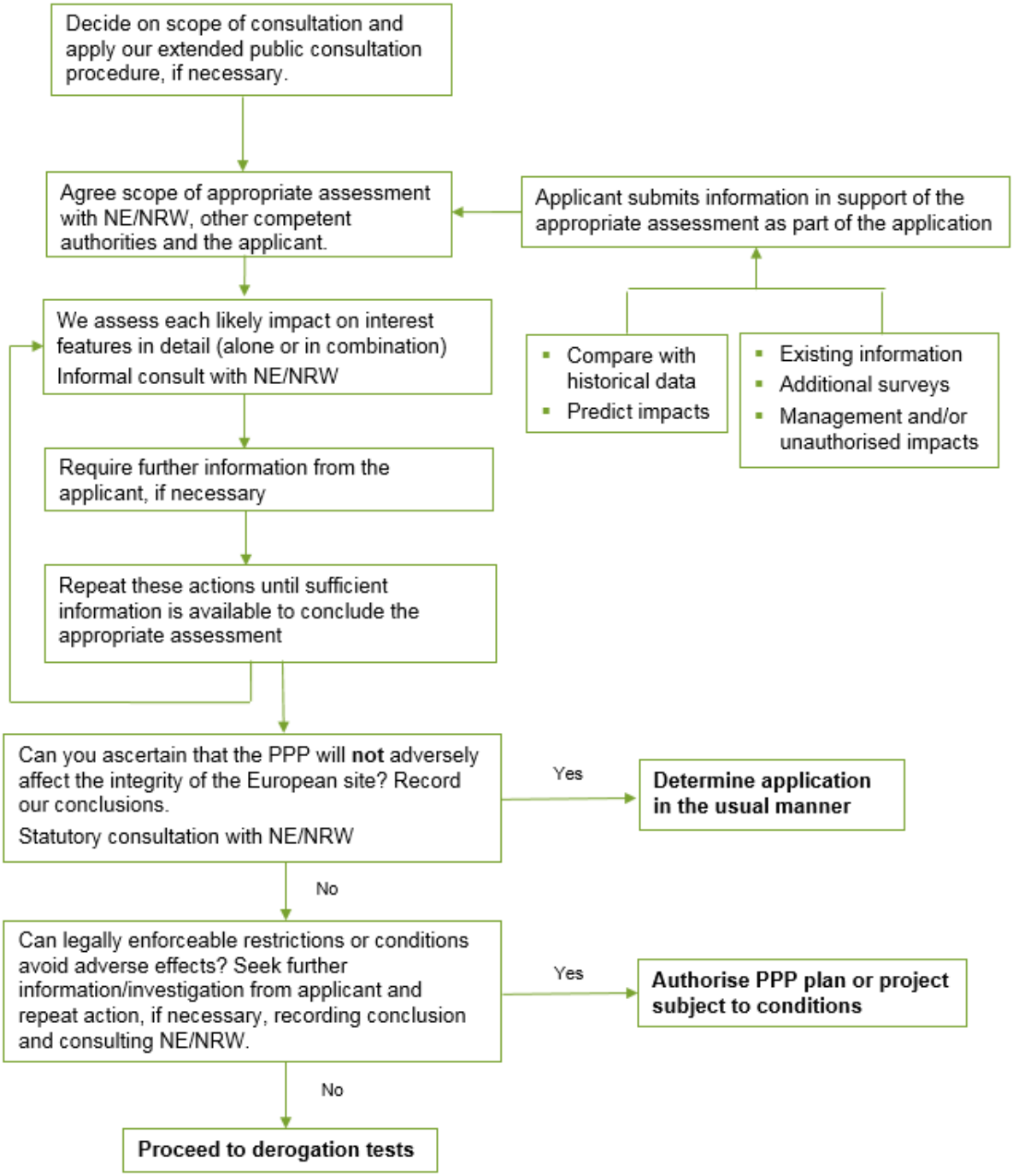
Regulation 63 of the Habitats Regulations requires the competent authority to consider within the assessment any PPP, including Environment Agency permissions and plans/projects that are likely to have a significant effect on a European site, either alone or in combination with other PPP. Where permissions indicate a likely significant effect, these will be assessed in combination with each other and with other relevant plans and projects.

The in-combination assessment can occur twice within the HRA process, once at the screening stage for likely significant effect and then again at the AA. At each step, inconsequential effects and effects where no pathway exists by which protected features could be affected are excluded. At each step, clarification is given on which emissions or possible effects will no longer be included in the in-combination assessments.

4.3.4. Appropriate assessment

Government competent authority advice (Defra and others, 2021) sets out the requirements of an appropriate assessment. The steps to follow are set out in Figure 1.

Figure 1: Summary of the steps to follow when carrying out an appropriate assessment



This AA stage determines whether, in view of the European site's conservation objectives, it can be ascertained that the permissions 'either alone or in combination with other plans or projects' would not have an adverse effect on the integrity of the site.

The 'integrity of the site' relates to the site's conservation objectives. This is because the appropriate assessment is to be carried out "in view of that site's conservation objectives" as per Regulation 63(1) of the Habitats Regulations.

The Managing Natura 2000 sites advice (European Commission, 2019) explains the concept of the 'integrity of the site' in section 4.6.4. It explains that:

- “the expression ‘integrity of the site’ shows that the focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State”
- integrity “clearly relates to ecological integrity. This can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation”
- “the ‘integrity of the site’ can usefully be defined as the coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated”
- “a site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required”

Taking each qualifying feature in turn, if the conservation objectives for a feature will be undermined, site integrity is not necessarily affected. On the contrary, site integrity cannot be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other plans or projects. This would include low-impact effects that are too small or short-lived to undermine the achievement of the conservation objectives.

Where it cannot be concluded that the permission will not have an adverse effect on the integrity of a site, the permission should be refused, unless mitigation in the form of restrictions or conditions can be imposed to ensure there is no adverse effect on the integrity of the site(s).

It is unlawful to rely on the provision of mitigation in the absence of information regarding the effectiveness of the mitigation: Case C-142/16 Commission v Germany (26 April 2017), [34]-[38]. In Case C-293/17, C-294/17 Coöperatie Mobilisation for the Environment and Vereniging Leefmilieu, at [126] and [130], the Court of Justice of the European Union (CJEU) held that it is only when it is sufficiently certain that a measure will make an effective contribution to avoiding harm to the integrity of the site concerned, by guaranteeing beyond all reasonable doubt that the plan or project at issue will not adversely affect the integrity of that site, that such a measure may be taken into consideration in the AA. Additionally, the CJEU held that the AA of the implications of a plan or project for the sites concerned is not to take into account the future benefits of such 'measures' if those benefits are uncertain, because, among other things, the procedures needed to accomplish them have not yet been carried out or because the level of scientific knowledge does not allow them to be identified or quantified with certainty.

4.3.5. The precautionary approach

A competent authority must apply a precautionary approach when undertaking an appropriate assessment. In practical terms, this means that:[1]

- the competent authority must be "certain" that the plan or project in question will not adversely affect the integrity of its site concerned: Waddenzee at paragraphs 56-57
- there should be "no reasonable scientific doubt" remaining as to the absence of such effects Waddenzee at [59]; and Case C-258/11 Sweetman and others v An Bord Pleanála [2014] P.T.S.R. 1092 at [45]-[49]
- this involves a "strict" precautionary approach: Smyth v Secretary of State for Communities and Local Government [2015] EWCA Civ 174 at [61]; that is, a "high standard of investigation": R (Champion) v North Norfolk District Council [2015] 1 WLR 3710, at [41]
- the appropriate assessment "cannot have lacunae and must contain complete, precise and definitive findings and conclusion capable of removing all reasonable scientific doubt as to the effects of the works proposed on the protected site concerned": Sweetman at [44]
- someone alleging that there was a risk that cannot be excluded on the basis of objective information must produce credible evidence that there was a real as opposed to hypothetical risk that must have been considered: Boggis v. Natural England [2009] EWCA Civ 1061 at [37]

The precautionary principle also has implications for the way in which proposed mitigation is treated by a competent authority:

- it is unlawful to rely on the provision of mitigation in the absence of information regarding the effectiveness of the mitigation: Case C-142/16 Commission v Germany (26 April 2017) at [34]-[38]
- it is only when it is sufficiently certain that a measure will make an effective contribution to avoiding harm to the integrity of the site concerned, by guaranteeing beyond all reasonable doubt that the project at issue will not adversely affect the integrity of that site, that such a measure may be taken into consideration in the appropriate assessment: Case C-293/17, C-294/17 Coöperatie Mobilisation for the Environment and Vereniging Leefmilieu at [126]
- the appropriate assessment must not take into account the future benefits of mitigation measures if those benefits are uncertain, for example, because the procedures needed to accomplish them have not yet been carried out or because the level of scientific knowledge does not allow them to be identified with certainty: Case C-293/17, C-294/17 Coöperatie Mobilisation for the Environment and Vereniging Leefmilieu at [126] and [130]

[1] See Jay J's summary in Wealden v SSCLG [2017] EWHC 351 (CD 13.1).

4.3.6. The derogation tests

If it is not possible to identify mitigation, it will be necessary to establish whether the permissions can be granted based on “imperative reasons of overriding public interest” (IROPI). It may be possible to proceed with issuing the PPP if all 3 of the following derogation tests are met: there are no alternative solutions; it is of overriding public interest; and compensatory measures are secured.

4.3.7. Concluding the appropriate assessment

The competent authority may only grant consent for a project following an appropriate assessment if it is “convinced” that the project will not adversely affect the integrity of the site concerned. Where doubt remains as to the absence of adverse effects on the integrity of the site, the competent authority will have to refuse authorisation: Waddenzee at [56]-[59].

The essential questions for the competent authority carrying out an appropriate assessment are: “what will happen to the site if this plan or project goes ahead; and is that consistent with ‘maintaining or restoring the favourable conservation status’ of the habitat or species concerned?”: C-258/11 Sweetman v An Bord Pleanála [2014] P.T.S.R. 1092, [50] of AG Sharpston’s Opinion.

Article 1(i)(b) of the Habitats Directive defines the favourable conservation status of a protected species to be when, among other things:

“…population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitat.”

The Supreme Court has held that “no special procedure is prescribed” for an appropriate assessment, but “a high standard of investigation is demanded” and “the issue ultimately rests on the judgment of the authority”: R (Champion) v North Norfolk District Council [2015] 1 W.L.R. 3710, at [41].

In Case C-164/17 Grace v An Board Pleanála (ESB Wind Developments intervening) at [39], the European Court of Justice (CJEU) held that an appropriate assessment may not have lacunae and must contain complete, precise and definitive findings and conclusions capable of dispelling all reasonable scientific doubt as to the effects of the proposed works on the protected area concerned. Furthermore, in Case C-461/17 Holohan v An Board Pleanála, at [33] and [37], the CJEU held that all aspects of a project which might affect the site’s conservation objectives must be identified and all the habitats and species for which the site is protected must be catalogued.

In carrying out an appropriate assessment, if no scientific certainty can be established even after having exhausted all scientific means and sources, it will be necessary to work with identified and reasoned probabilities and estimates: Waddenzee AG Kokott’s Opinion [97]-[98].

On completing an AA, the competent authority is required to consult with the statutory nature conservation body (SNCB) and have regard to any representations made by that body within such reasonable time as the authority specifies. Case law has found that the views of expert statutory consultees in the field of nature conservation are to be given weight by decision-makers and that cogent and compelling reasons are required for departing from such advice: for example, Hart DC v SSCLG [2008] 2 P. & C.R. 16 at [42] and R (Akester) v Defra [2010] EWHC 232 (Admin) at [112]. Decision makers, such as the Environment Agency in carrying out our AA, have an enhanced margin of appreciation in cases involving scientific, technical and predictive assessments: R (on the application of Mott) v Environment Agency [2016] EWCA Civ [2016] 1 WLR 4338 at [64, 69 and 74].

4.3.8. Consideration of mitigation measures

The following is from the 'Habitats regulations assessments: protecting a European site' competent authority guidance (Defra and others, 2021) available on gov.uk website:

"As part of your appropriate assessment, you should consider any mitigation measures that have been included as part of the proposal to remove or reduce potential adverse effects."

"You should assess what difference the mitigation measures would make to the effects of the proposal on the site. You must be sure that the mitigation will be effective. To do this, your assessment will need to show:

- how the measures would be implemented and monitored, and how long for
- how you would enforce the measures if you had to
- how certain you are that the measures would work to avoid or reduce effects on the site
- how long it will take for the measures to take effect
- the level of success you expect, or what changes you'd make if monitoring shows the measures may fail

You must make sure that any necessary mitigation measures are put in place now and not wait for adverse effects to happen first."

Attach conditions

The guidance for competent authorities (Defra and others 2021), states that:

"If mitigation measures are needed to avoid adverse effects, you should attach conditions or take other necessary steps to make sure the measures are carried out.

You can make conditions flexible. For example, you could remove conditions if it's clear from monitoring that the risk of negative effects is lower than first thought.

You should be sure you can enforce the conditions if you need to, and that the proposer is capable of fulfilling them."

This guidance is available via this link: gov.uk

Monitoring conditions

A competent authority can attach monitoring conditions to a permit to "check whether the mitigation measures are working as expected", using monitoring as an early warning to identify the risk of any new potential impacts.

The guidance for competent authorities (Defra and others, 2021) states that:

"Monitoring conditions should clearly state what action the proposer will need to take to make sure adverse effects do not occur if either the:

- impacts are likely to be greater than expected
- mitigation might not be working as expected"

4.3.9. Functional linkage

In developing the methodology for this appropriate assessment, we have referred to a Natural England commissioned report (Chapman and Tyldesley, 2016), on functional linkage.

Within the report, the term 'functional linkage' refers to "the role or 'function' that land or sea beyond the boundary of a European site might fulfil in terms of ecologically supporting the populations for which the site was designated or classified for. Such land is therefore 'linked' to the European site in question because it provides an important role in maintaining or restoring the population of qualifying species at favourable conservation status."

5. Relevant European sites

To assess the potential impact of the operation of Hinkley Point C, we first need to establish which sites could potentially be at risk; this requires us to define our screening parameters. The permission does not have to be located within a site or discharge directly into one for there to be an effect. For this assessment, we will consider if there is a source-receptor pathway for any potential effects from the operational WDA permit variation.

Firstly, we have sites that have 'direct connectivity'. These are sites where the permission is located within or discharges directly into it.

There are potentially a number of more distant UK sites that need considering in the HRA. These sites have mobile features such as birds, marine mammals, and migratory fish that can travel great distances. Such species could potentially be present within the waters affected by the HPC FRR system outlet, therefore the potential impact on them must be considered. In a case such as this, the area impacted by the outlet is considered to be 'functionally linked' to these distant sites.

The Severn Estuary SAC is designated for river lamprey, sea lamprey and twaite shad. Allis shad, Atlantic salmon, sea trout and European eel are a part of the assemblage of

fish species, which is a sub-feature of the estuary feature of the SAC and the migratory fish assemblage of the Severn Estuary Ramsar. This assessment will determine whether other European sites with these species are functionally linked to the Severn Estuary.

The following list of European sites has been identified using principles outlined as requiring assessment within this HRA. They all contain features that have the potential to be directly or indirectly affected by the permissions. Sites that were identified in the HRA for the HPC project, but do not have the potential to be affected by the proposal (due to a lack of an impact mechanism or sensitive receptor), are not included in this assessment. Maps showing the location of the sites are provided in Appendix 1 of this HRA (Environment Agency, 2023a; Appendix 1).

5.1. Sites with direct connectivity to the discharge

The FRR system outlet discharges directly into the Severn Estuary SAC and close to the Severn Estuary SPA and Severn Estuary Ramsar sites. The site features have been obtained from the Regulation 33 package for the Severn Estuary SAC, SPA and Ramsar (Natural England and CCW, 2009)

Severn Estuary SAC

Estuaries:

- Atlantic salt meadows
- hard substrate habitats (including eel grass beds)
- intertidal mudflats and sandflats
- notable estuarine assemblages – assemblage of fish species, assemblage of waterfowl species and assemblages of vascular plant species
- reefs
- subtidal sandbanks

Subtidal sandbanks:

- sublittoral cohesive mud and sandy mud communities
- sublittoral sands and muddy sand communities

Intertidal mudflats and sandflats:

- intertidal mud communities
- intertidal muddy sand communities
- intertidal gravel and clean sand communities

Atlantic salt meadows:

- low-mid marsh communities
- mid-upper marsh communities
- transitional high marsh communities
- pioneer saltmarsh communities

Reefs

Annex II species:

- River lamprey
- Sea lamprey
- Twaite shad

Severn Estuary SPA

Annex I species:

- Bewick's swan

Internationally important population of regularly occurring migratory species:

- European white-fronted goose
- dunlin
- redshank
- shelduck
- gadwall

Internationally important assemblage > 20,000 waterfowl:

- Bewick's swan
- curlew
- dunlin
- European white-fronted goose
- gadwall
- grey plover
- pintail
- pochard
- redshank
- ringed plover
- shelduck
- spotted redshank
- teal
- tufted duck
- whimbrel
- wigeon

Severn Estuary Ramsar

Estuaries:

- hard substrate habitats (rocky shores)

- intertidal mudflats and sandflats
- notable estuarine species assemblages
- saltmarshes

Internationally important populations of waterfowl:

- Bewick’s swan
- dunlin
- European white-fronted goose
- redshank
- gadwall
- shelduck

Assemblage of migratory fish species:

- allis shad
- Atlantic salmon
- eel
- river lamprey
- sea lamprey
- sea trout
- twaite shad

Nationally important assemblage of waterfowl:

- Bewick’s swan
- curlew
- dunlin
- European white-fronted goose
- gadwall
- grey plover
- pintail
- pochard
- redshank
- ringed plover
- shelduck
- spotted redshank
- teal
- tufted duck
- whimbrel
- wigeon

The Severn Estuary SAC, Severn Estuary SPA and Severn Estuary Ramsar are collectively known as the Severn Estuary European Marine Site (EMS).

5.2. Sites with designated fish species

The following European sites will be considered in this HRA as they are designated for the same Annex II migratory fish species as the Severn Estuary SAC and Severn Estuary Ramsar. There could be a functional linkage between the estuary and these sites.

River Wye SAC

- allis shad
- Atlantic salmon
- river lamprey
- sea lamprey
- twaite shad

River Usk SAC

- allis shad
- Atlantic salmon
- river lamprey
- sea lamprey
- twaite shad

5.3. Sites with designated bird populations

The following European sites will be considered in this HRA as they are designated for bird populations that could use the estuary close to the FRR discharge outlet as functionally linked land.

Somerset Levels and Moors SPA

- Bewick's swan
- European golden plover
- northern lapwing
- Eurasian teal
- waterbird assemblages

Somerset Levels and Moors Ramsar

- Bewick's swan
- northern lapwing
- Eurasian teal
- waterbird assemblages

5.4. Marine mammals

The closest site to HPC is the Bristol Channel Approaches SAC which is approximately 101km away and is designated for Harbour Porpoise, which are present within Bridgwater Bay.

6. Conservation objectives

The conservation objectives for the relevant European sites must be considered when concluding an assessment under the Habitats Regulations.

We have referred to the advice given under the Regulation 33(2)(a) written by the Countryside Council for Wales and Natural England, which includes the conservation objectives for the Severn Estuary SAC, SPA, and Ramsar (Natural England and CCW, 2009).

For marine sites, we have referred to Advice under Regulation 21 of The Conservation of Offshore Marine Habitats and Species Regulation 2017 and Regulation 37(3) of the Conservation of Habitats and Species Regulations 2017 (as amended).

For freshwater sites and SPAs, we have referred to the site's conservation objectives, and supplementary advice packages, where available.

Natural England's generic conservation objectives for SACs state that:

"With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' of the site(s)), and subject to natural change;

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 habitats of qualifying species rely
- the populations of qualifying species, and,
- the distribution of qualifying species within the site."

Natural England's generic conservation objectives for SPAs state that:

"With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

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

Site specific conservation objectives will be referred to and assessed against in this HRA where available.

7. Associated risks

The following are the reasonably foreseeable risks for water discharge activities, as generated via our internal Habitat Regulations Assessment system (HRAS) database:

- change in thermal regime
- toxic contamination
- nutrient enrichment
- turbidity
- siltation
- physical damage
- pH
- change in salinity regime
- smothering and indirect habitat loss

Some of these risks may not be relevant to the proposed variation of the operational WDA at HPC and this will be explained in 7, associated risks. Risks which are not relevant do not require further assessment within this HRA.

In addition, due to the nature of the proposed discharge, it is considered there is the potential for an indirect effect of smothering and resultant habitat loss of directly protected habitats or supporting habitats of protected features.

7.1. Change in thermal regime

This risk is not relevant to the operational WDA permit variation as there will be no discharge of heated water from the FRR system outlet.

This risk will not be considered further in this assessment.

7.2. Toxic contamination

Dead and moribund biota from the FRR systems could contribute to toxic contamination.

Background to this risk:

The potential for toxic contamination from the discharge of polluting matter from the FRR system discharge has been assessed by calculating the mixing zones required for unionised ammonia and biological oxygen demand (BOD), to meet the respective EQS'.

Ammonia is toxic to fish species and can cause mortality in high concentrations. In water ammonia occurs in two forms ionised ammonia (NH4+) and unionised ammonia (NH3). Unionised ammonia is the form that is toxic to fish. The relative amount of unionised ammonia is dependent on the temperature, salinity, and pH within the estuary.

Biochemical Oxygen Demand (BOD) is an indicator of organic pollution. It refers to the amount of oxygen required to break down any organic matter found in water bodies. When organic matter is present in a water body, microorganisms use the dissolved oxygen in water to break down to organic matter. This action reduces the overall oxygen available within the area.

This assessment will consider changes in unionised ammonia and BOD from the discharge of dead and moribund biota from the fish recovery and return (FRR) system.

7.3. Nutrient enrichment

Dead and moribund biota from the FRR systems could contribute to nutrient enrichment.

Background to this risk: Eutrophication is the gradual increase and enrichment of ecosystems by nutrients, such as nitrogen (N) and/or phosphorus (P). For example, WDAs containing treated sewage effluent will have elevated phosphorus and nitrogen levels relative to the receiving water. The addition of nutrients may lead to changes in nutrient sensitive vegetation, either directly affecting protected habitats and species of flora, or indirectly affecting protected species dependent upon existing habitats.

When there are excessive nutrients in intertidal habitats, dense algal mats can form. These can smother the intertidal habitat, prevent oxygen and nutrient flow, and block light. Algal mats can also form a barrier to birds which feed by probing the intertidal mud. This can, in turn, impact on the availability and suitability of bird breeding, rearing, feeding and roosting habitats.

In salt marshes, changes to the nutrient status of the underlying sediment (away from typical natural values) and the processes that allow the effective cycling of nutrients, may affect the vegetation communities.

High concentrations of nutrients in the water column can also cause 'phytoplankton' and opportunistic 'macroalgae' blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, as well as biological communities living on or within the

substrate, and therefore adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats.

This assessment will consider changes in nutrients/eutrophication from the discharge of dead and moribund biota from the fish recovery and return (FRR) systems. Indirect effects may occur if the integrity of the site is affected by changes in water quality. Our assessment considers:

- nutrient concentrations
- phytoplankton production
- organic enrichment

There is also the potential for an indirect effect from nutrient enrichment, where the settlement of moribund biota on intertidal and subtidal habitats could result in a shift in their community composition. These areas could become dominated by predators such as crab and starfish.

7.4. Turbidity

The WDA has the potential to increase turbidity (the measure of suspended solids in the water) due to the discharge of dead and moribund biota contributing to nutrient enrichment, leading to an increase in phytoplankton production. There are no other potential turbidity effects as the turbidity of the water being discharged will effectively be equal to that being abstracted, and to the background level.

The high natural turbidity of the Estuary is acknowledged within the Regulation 33 document (Natural England and CCW, 2009) which states that “Fine sediments which are mainly derived from erosion of the intertidal zone and suspended sediments in river water entering the estuary create high turbidity, which has its highest average level between Avonmouth and the outer part of Bridgwater Bay (British Geological Survey, 1996, ABPMer, 2006). The strong tidal currents create a highly dynamic environment and the resultant scouring of the seabed and high turbidity give rise to low diversity communities.” (p.32).

This risk will not be considered further in this assessment.

7.5. Siltation

This risk is not relevant to the operational WDA permit variation as there will be no discharge of suspended solids from the FRR system outlet.

This risk will not be considered further in this assessment.

7.6. Physical damage

This risk is not relevant to the operational WDA permit variation as discharge will not be strong enough to cause damage to the local habitat.

This risk will not be considered further in this assessment.

7.7. pH

There will be no change in pH as the discharge will be dead and moribund biota from the FRR systems. This risk will not be considered further in this assessment.

This risk will not be considered further in this assessment.

7.8. Changes in salinity regime

There will be no change in salinity as the discharge will be dead and moribund biota from the FRR systems.

This risk will not be considered further in this assessment.

7.9. Smothering and indirect habitat loss

An assessment will be made of the potential for the FRR system discharge to settle on the estuary bed or intertidal habitats causing smothering and potentially habitat loss.

7.10. Conclusion

This assessment will therefore focus on the following risks:

- toxic contamination
- nutrient enrichment
- smothering and indirect habitat loss

8. Likely significant effect

Regulation 63(1) of The Conservation of Habitats and Species Regulations 2017 requires the competent authority to carry out a screening exercise to identify those permissions, plans or projects (PPP) that are likely to have a significant effect on the features of a European site. These effects are then subject to appropriate assessment.

For this assessment, a very high level and precautionary likely significant effect (LSE) stage will be carried out considering a simple source-receptor pathway link due to the bespoke detailed modelling submitted with the application and associated detailed assessment work that was carried out for this HRA. This is in line with Bagmoor Wind case law, which says:

“A project is ‘likely to have a significant effect’ if there is a real risk of a likely significant effect occurring that is, the risk of it occurring cannot be excluded on the basis of objective information

“If the absence of risk in the plan can only be demonstrated after a detailed investigation, or expert opinion, that is an indicator that a risk exists and the authority must move from preliminary examination to appropriate assessment”.”

For the operational WDA permit, we have used a simple source-receptor pathway approach for the LSE screening as follows:

1. Is there a pathway such that the potential hazard could affect the interest features alone? If it is considered there is no connectivity, or any connectivity or effect would be of low-impact and too small to result in a conceivable effect on the feature or site then no in-combination assessment is required.

2. What is the exposure of the feature to this hazard?

3. For each hazard, is the potential scale or magnitude of any effect likely to be significant? The aim of the screening process is to identify those hazardous chemicals and elements within the process waste streams that may contribute to the deterioration of the receiving water body. This may be through preventing the achievement of the conservation objectives for a European site.

For any risks identified above that fail the screening process, there may be a need for further assessment or investigation via the completion of appropriate bespoke modelling. The applicant can complete this modelling as part of its supporting information, and we review and audit it as part of the permit application’s determination and appropriate assessment.

8.1. LSE assessment for the European sites

The potential for likely significant effect on European sites is considered in sections 8.1.1 to 8.1.4. Firstly, we consider the potential for LSE on designated sites within the Severn Estuary (section 8.1.1). Migratory and highly mobile features of more distant designated sites are then considered to establish whether they are ecologically functionally linked to the Severn Estuary European sites (sections 8.1.2, 8.1.3 and 8.1.4).

Please note that the likely significant effect conclusions for all sites and features are summarised in the LSE screening spreadsheet, Appendix 5 of this HRA.

8.1.1. Sites with direct connectivity to the discharge

Severn Estuary SAC

The FRR system outlet discharges into the Severn Estuary SAC and all its features are sensitive to the risks described in section 7 of this HRA.

It is therefore considered to be LSE alone, and the site and the features will be taken forward into appropriate assessment to assess, by detailed modelling, whether the FRR system discharge could affect the integrity of the SAC.

Severn Estuary SPA

The FRR system outlet discharges near the Severn Estuary SPA and all its features are sensitive to the risks described in section 7 of this HRA.

There is therefore considered to be LSE alone and the site and the features will be taken forward into appropriate assessment to assess, by detailed modelling, whether the FRR system discharge could reach the site and therefore the supporting habitat of the SPA bird features.

Severn Estuary Ramsar

The FRR system outlet discharges near the Severn Estuary Ramsar and all its features are sensitive to the risks described in section 7 of this HRA.

There is therefore considered to be LSE alone and the site and the features will be taken forward into appropriate assessment to assess, by detailed modelling, whether the FRR system discharge could reach the site and therefore the features and supporting habitats of the Ramsar.

8.1.2. Sites with designated fish species

River Usk SAC

The Severn Estuary is functionally linked as a migratory pathway for the Annex II species of the River Usk SAC, which are sensitive to the risks described in section 7 of this HRA.

There is therefore considered to be LSE alone and the site and the features will be taken forward into appropriate assessment to assess, by detailed modelling, whether the FRR system discharge could affect the integrity of the SAC.

River Wye SAC

The Severn Estuary is functionally linked as a migratory pathway for the Annex II species of the River Wye SAC, which are sensitive to the risks described in section 7 of this HRA.

There is therefore considered to be LSE alone and the site and the features will be taken forward into appropriate assessment to assess, by detailed modelling, whether the FRR system discharge could affect the integrity of the SAC.

8.1.3. Sites with designated bird populations

The bird features of the Somerset Levels and Moors SPA and Somerset Levels and Moors Ramsar are associated with marine/estuarine and intertidal habitats. The Severn Estuary is therefore functionally linked to the features of the SPA, which are sensitive to the risks described in section 7 of this HRA.

There is therefore considered to be LSE alone and the site and the features will be taken forward into appropriate assessment. The appropriate assessment will consider the sites

with direct connectivity to the discharge first, if it is possible to conclude no adverse effect on these sites, the same conclusion will be applied to the distant fish sites.

If a conclusion of no adverse effect cannot be reached for the sites with direct connectivity, then an assessment will also be made on the Somerset Levels and Moors SPA and Somerset Levels and Moors Ramsar.

8.1.4. Marine mammals

Harbour porpoise

Harbour porpoise is a feature of the Bristol Channel Approaches SAC

As set out in the ecological narrative (Environment Agency, 2023b; Appendix 2), the Bristol Channel and Approaches SAC supports a population of harbour porpoise that are functionally linked to the Severn Estuary. The SAC has been designated because of its importance to harbour porpoise in the winter months (October to March) and is the closest harbour porpoise site to HPC. The Conservation Objectives and Advice on Operations (JNCC, March 2019) states that:

“This SAC has been selected primarily based on the long-term, relatively higher densities of porpoise in contrast to other areas of the MU. The implication is that the SAC provides relatively good foraging habitat and may also be used for breeding and calving. However, because the number of harbour porpoise using the site naturally varies (e.g., between seasons), there is no exact number of animals within the site”.

The “Conservation Objectives and Advice on Operations” (JNCC and NE, 2019) advice for the Bristol Channel Approaches SAC lists contaminants from discharges as a pressure on the SAC with one of the potential impacts listed as effects on water quality.

Due to the functionality between the Severn Estuary and the Bristol Channel Approaches and the identified threats to the harbour porpoise, it is not possible to conclude no likely significant effect from the proposed permit variation.

9. Appropriate assessment (AA) methodology

The following risks have been brought forward from LSE to this AA:

- toxic contamination
- nutrient enrichment
- indirect smothering and habitat loss

9.1. Methodology: nutrient enrichment and toxic contamination

The methodology for our assessment of the impact of the proposed permit variation has considered a quantitative approach based on the applicant’s technical report TR515 "HPC Water quality effects of the fish recovery and return system" (NNB GenCo, 2020a; TR515).

The generic approach taken in TR515 is summarised below, together with additional scenarios undertaken with our estimate of the discharge of moribund biomass from the FRR system. This biomass is based on our estimate of the survival of fish species passing through the FRR system (Environment Agency (2023d; AR001). We considered these values when completing this appropriate assessment.

General steps in the TR515 analysis are:

1. Calculate the biomass of moribund organisms from the HPC FRR system. This calculation is based on the applicant's results (NNB GenCo, 2018; TR456) and the mean daily biomass discharge from December (the month with the highest biomass discharge at HPB) is carried forward to the calculations:
   - the results of the particle tracking study (NNB GenCo, 2020b; TR479) are not used here as it assumed that 88% of dead sprat sank immediately, and once on the bottom, did not move again. As a precautionary measure, TR515 assumes that 100% of the dead fish discharged from the FRR system outlet will sink immediately and not be resuspended or advected over a larger area.

2. A literature review was conducted to calculate the decay products of the dead fish:
   - we have reviewed the literature cited and have found no more relevant sources, so we accept the values provided

3. The daily loading of breakdown products (nitrogen, phosphorus, unionised ammonia, BOD and organic carbon) is calculated using the biomass from Step 1 and the literature values in Step 2

4. The volume of water (in litres) that would be needed to dilute the daily loadings to relevant standard is then calculated

5. This volume is turned into an area (m^2) of potential impact by assuming the effluent is mixed throughout the 7m water column

6. The volume is then compared to the daily tidal exchange (the Severn Estuary has two high and low tides each day and a 5% exchange on each tide, giving a daily 10% volume exchange) to conclude that the daily effluent discharge, from the breakdown of the dead fish leaving the FRR system, is a very small percentage of the total daily tidal exchange for Bridgwater Bay

7. Finally, a plume footprint is estimated for organic enrichment (the discharge with the largest predicted impact) using discharge model results for the main cooling water outlet. This footprint is compared against sensitive habitats in the area (Figure 2)

The process in which our assessment was completed is identical to the analysis in TR515 (NNB GenCo, 2020a; TR515); however, the loadings of dead biota discharged from the FRR system have been revised based on our impingement assessments (Environment Agency, 2023d; AR001) and several scenarios have been considered including:

- the daily average from the month with the highest moribund biomass discharge of the fish species considered in TR515 (this scenario is the most consistent with the TR515 analysis)
- the discharge on the day with the highest biomass discharge of these same fish species. This daily maximum event occurred in June
- the daily average from the month with the highest moribund biomass discharge of all species of fish (December)
- the daily average from the month with the highest total moribund biomass of all fish plus invertebrate species (also December)

There are several uncertainties in all these calculations. The factors used to calculate the breakdown products are specific to one or a limited number of species or studies; they do not strictly apply to all fish/invertebrate species. In the absence of more or better data, it was considered acceptable to apply the factors universally.

The approach also does not take account of dispersal, accumulation, or consumption by detritivores. Our figures are thought to provide a worst-case acute impact. In the dynamic environment of Bridgwater Bay and the Severn Estuary, dispersal could be quite large.

TR515 (NNB GenCo, 2020a; TR515) presents a method to estimate the nutrient and pollutant loads in the marine environment due to the FRR system discharge, based on the biomass estimates, as described above. The loads are interpreted in terms of the volume of water and area of sea needed to dilute the pollutant to Environmental Quality Standard (EQS) concentration – that is, an estimated size of mixing zone.

The mixing zone is defined as the predicted area of the receiving water body that is expected to contain concentrations of these substances above the relevant EQS value as a result of the discharge. These mixing zones are based on a conservative model that does not account for the dynamic nature of the Severn Estuary or the movement and resuspension of discharged biota.

TR515 (NNB GenCo,2020a; TR515) provides an indication of the size of the mixing zone, or carbon footprint, predicted by the applicant from the FRR system discharge point (Figure 2) and location of the broad European Nature Information Systems (EUNIS) habitat groups, this is Figure 3 in TR515.

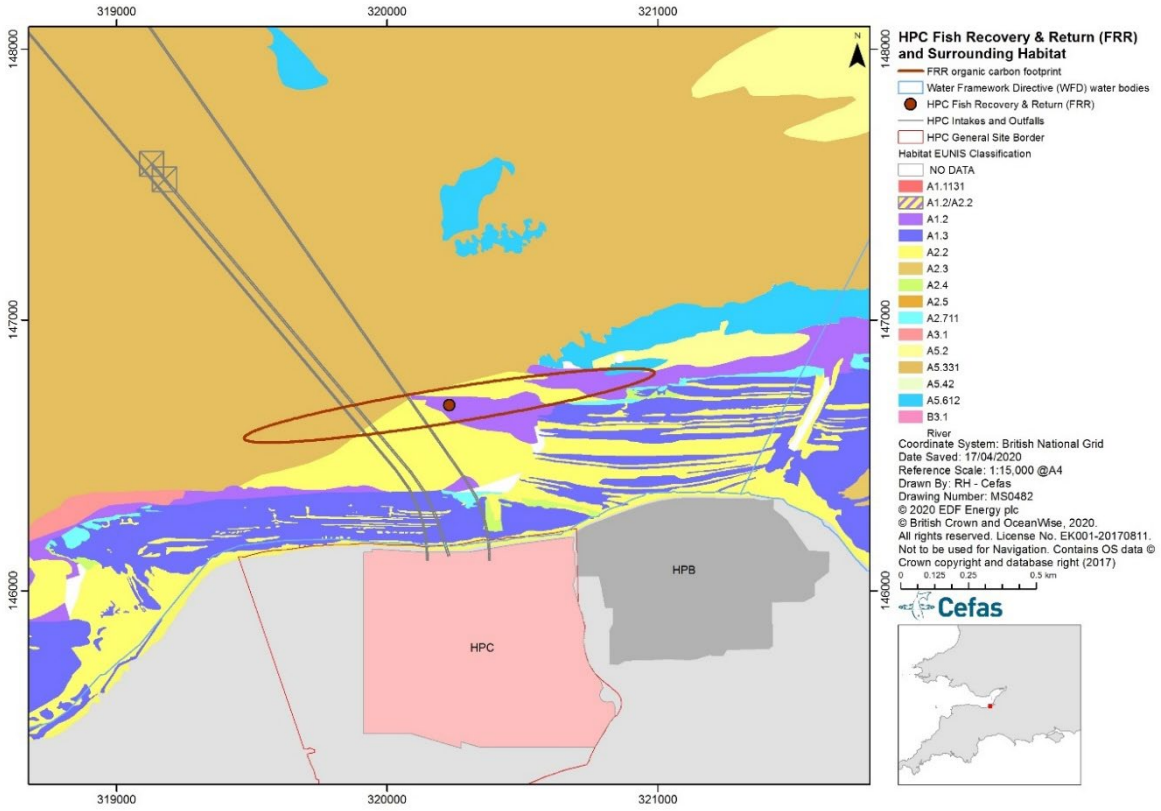


Figure 2 Location of the FRR system discharge shown by the red dot, the ellipse shows the worst-case organic enrichment footprint of the FRR system discharge. This is Figure 3 in TR515 (NNB GenCo, 2020a; TR515)

The colour shaded areas correspond to different EUNIS habitats with EUNIS codes shown in the legend and in more detail in Table 1.

Table 1 EUNIS habitat total area information for the Severn Estuary of relevance to FRR system discharge

EUNIS level	EUNIS code	EUNIS habitats description	Area (ha)
6	A1.1131	[Semibalanus balanoides], [Patella vulgata] and [Littorina] spp. on exposed to moderately exposed or vertical sheltered eulittoral rock	4.5
3	A1.2/A2.2	moderate energy littoral rock/Littoral sand and muddy sand	13.4
3	A1.2	moderate energy littoral rock	126.8
3	A1.3	low energy littoral rock	35.5

3	A2.2	littoral sand and muddy sand	255
5	A2.312	[Hediste diversicolor] and [Macoma balthica] in littoral sandy mud	3532.5
3	A2.4	littoral mixed sediments	54.8
3	A2.5	coastal saltmarshes and saline reedbeds	186.5
5	A2.711	honeycomb worm reefs on sand-abraded eulittoral rock	11.6
3	A3.1	Atlantic and Mediterranean high energy infralittoral rock	143.2
4	A5.2	sublittoral sand	191.1
5	A5.331	[Nephtys hombergii] and [Macoma balthica] in infralittoral sandy mud	7512.7
4	A5.42	sublittoral mixed sediment in variable salinity (estuaries)	604.8
5	A5.612	[Sabellaria alveolata] on variable salinity sublittoral mixed sediment	3503.7
3	B3.1	Atlantic and Mediterranean high energy infralittoral rock	143.2

Table 2 to Table 5 present a summary of the predicted water quality effects of HPC's FRR system discharge. These tables compare the results provided in TR515 (NNB GenCo, 2020a; TR515) to our revised figures. The process in which these figures were calculated is identical to the analysis in TR515, with the exceptions listed in section 9, Appropriate assessment (AA) methodology.

As mentioned in section 9, there are a number of uncertainties in all of these calculations. The factors used to calculate the breakdown products are specific to one or a limited number of species or studies; they do not strictly apply to all fish/invertebrate species. In the absence of more or better data, it was considered acceptable to apply the factors universally.

If the daily carbon input were evenly spread, so that the release of carbon/m² occurred at the proxy EQS rate, then an area of 275,471m² (Table 5) would be affected. However,

particle tracking predicts that dead biota will in fact disperse over a much greater area and so, the release of carbon/m² will be diluted and will generally be below the EQS rate due to the dynamic nature of the estuary. There may be very localised areas where carbon input exceeds the EQS, associated with particularly large dead biota.

However, it is worth noting that the rate of discharge from the FRR system is seasonal, the month with the highest total dead biomass of all fish plus invertebrate species is expected to be December (489.4kg), whilst TR515 predicts the lowest rate of discharge to occur in the spring months, March to May, and October, however this is based on the most abundant fish only.

Our assessment (Environment Agency, 2023d; AR001) estimates that the minimum daily average of discharged fish and invertebrates be 105kg and occur in March. This compares with a maximum daily average of 489.4kg in December. It serves to illustrate that applying the figure for December uniformly over the year is very conservative and will over-estimate impacts.

The applicant's assessment (NNB GenCo, 2020a; TR515) gives the daily average loading of impinged fish for December as 135.6kg. Our calculations have resulted in the following daily loadings for December and June:

- December daily average of fish species included in TR515 only – 241.9kg
- June daily maximum of fish species included in TR515 only – 441.3kg
- December daily average for all fish – 461.4kg
- December daily average for all fish and invertebrates – 489.4kg

Table 2 Calculations of the phosphorus and nitrogen inputs based on estimates of nutrient tissue concentrations

Nutrient input	December daily average (TR515v2)	December daily average, TR515v2 species (EA)	June daily maximum, TR515v2 species (EA)	December daily average – all fish (EA)	December daily average – all fish and inverts (EA)
max daily P content (kg)	0.68	1.21	2.21	2.31	2.4
max daily N content (kg)	4.75	8.47	15.45	16.15	17.13

Table 3 Calculations of the volume of seawater required to dilute this mass of ammonia to the environmental quality standard (EQS) with and without temperature uplift

Unionised ammonia	December daily average (TR515v2)	December daily average, TR515v2 species (EA)	June daily maximum, TR515v2 species (EA)	December daily average – all fish (EA)	December daily average – all fish and inverts (EA)
Total NH_4 (mg)	16,950	30,237	55,167	57,681	61,175
Unionised ammonia from calculator (mg)	350	624	1,138	1,190	1,262
Volume required to dilute to EQS (l)	18,973	33,845	61,750	64,564	68,475
Area required to reach EQS (m^2)	1.65	4.83	8.82	9.22	9.78

Table 4 Calculations of the estimated area needed to meet oxygen demand through reaeration

Influence on dissolved oxygen	December daily average (TR515v2)	December daily average, TR515v2 species (EA)	June daily maximum, TR515v2 species (EA)	December daily average – all fish (EA)	December daily average – all fish and inverts (EA)
BOD (kg)	170.9	304.8	556.1	581.4	616.6
O_2 reduction (kg/day)	57	101.6	185.4	193.8	205.5
Area needed to meet oxygen demand through reaeration (m^2)	17,798	31,749	57,926	60,565	64,234
Area needed to meet oxygen demand through reaeration (km^2)	0.018	0.032	0.058	0.061	0.064

Table 5 Calculations of the area affected by organic enrichment

Organic enrichment	December daily average (TR515v2)	December daily average, TR515v2 species (EA)	June daily maximum, TR515v2 species (EA)	December daily average – all fish (EA)	December daily average – all fish and inverts (EA)
Carbon load (kg/day)	42.3	75.5	137.7	144.0	152.7
Area affected (m^2)	154,421	275,471	502,595	525,494	557,328
Area affected (km^2)	0.15	0.28	0.50	0.53	0.56

9.1.1. Toxic contamination

Toxic contamination has the potential to negatively affect the communities that are supported by the interest features and sub-features of the Severn Estuary SAC and Ramsar and impede the migration of Annex II fish species and the species of the migratory assemblage to their spawning grounds in the rivers.

The potential for toxic contamination from the discharge of polluting matter from the FRR system discharge has been assessed by calculating the mixing zones required for unionised ammonia and biochemical oxygen demand (BOD), to meet the respective EQS' (21µg l^{-1} for unionised ammonia and BOD assessed to a background dissolved oxygen concentration of 5mg l^{-1}). Any overlap between the mixing zone and an interest feature of the Severn Estuary SAC or Ramsar may result in an adverse effect on site integrity.

The mixing zones were calculated using several scenarios as set out in Table 2 to Table 5. The worst-case scenario is the daily average for all fish and invertebrates for December, which will be used to inform this assessment. This resulted in an area of:

- 9.78m^2 being required to meet the EQS for unionised ammonia
- 0.064km^2 being needed to meet the oxygen demand through reaeration

9.1.2. Nutrient enrichment

Nutrient enrichment has the potential to negatively affect the communities and species that are supported by the interest features and sub-features of the Severn Estuary SAC and Severn Estuary Ramsar by causing excess primary production (phytoplankton growth).

Our assessment considers:

- nutrient dissolved inorganic nitrogen (DIN) concentrations
- phytoplankton production
- organic enrichment

The potential for nutrient enrichment from the discharge of polluting matter from the FRR system discharge has been assessed by calculating the area affected by nutrient enrichment, or eutrophication. An overlap between this area and an interest feature of the Severn Estuary SAC or Severn Estuary Ramsar may result in an adverse effect on site integrity.

This area was calculated using several scenarios as set out in Table 2 to Table 5. The worst-case scenario is the daily average for all fish and inverts for December, which will be used to inform this assessment. This resulted in an affected area of 0.56km².

9.2. Methodology: smothering and habitat loss

This methodology and assessment reference the WFD assessment completed for the permit variation as the best available information for this appropriate assessment (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C).

An assessment was included in NNB GenCo (2020a; TR515) of the potential impacts of fish matter discharged from the FRR system outlet on benthic habitats in the vicinity of the FRR system discharge. Reassessment of the impingement and mortality of fish (and hence the expected release matter through the FRR system) predicted considerably higher impingement and mortality through the FRR system than previous estimates (Environment Agency, 2023d; AR001). As such, reconsideration of the impacts of organic matter release on benthic habitats is required.

Quantitative predictions of the footprint of materials exiting the FRR have not been produced by the applicant. An assessment of the dispersal of sprat following discharge from the FRR was conducted by NNB GenCo (2020b; TR479)[2], which predicted that the currents in the vicinity of HPC will distribute material discharged from the FRR along an approximately 12 km stretch of coastline, as shown in Figure 4 (taken from Figure 6, NNB GenCo, 2020b; TR479). Our WFD assessment (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C) suggests that the discharge could cover an area of between 0.16 and 6.3km² within Bridgwater Bay WFD water body,

[2] Sprat were assessed on the basis of them being the numerically dominant contributors to discharged fish matter

and in the region of 5km² within the Parrett WFD water body, giving a total estimated area of 11.3km² within the Severn Estuary SAC.

This modelling was used in the WFD assessment (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C), which suggests that the footprint from the FRR system discharge is predicted to cover an area between 0.16 and 6.3 km² within Bridgwater Bay WFD water body, and in the region of 5 km² within the Parrett WFD water body, giving a total estimated area of 11.3km² within the Severn Estuary SAC and Severn Estuary Ramsar. Whilst the WFD assessment is a separate legal requirement to the HRA, the findings can be used to inform the conclusions of the HRA. The WFD water bodies are shown in relation to the FRR system outlet in Figure 3.

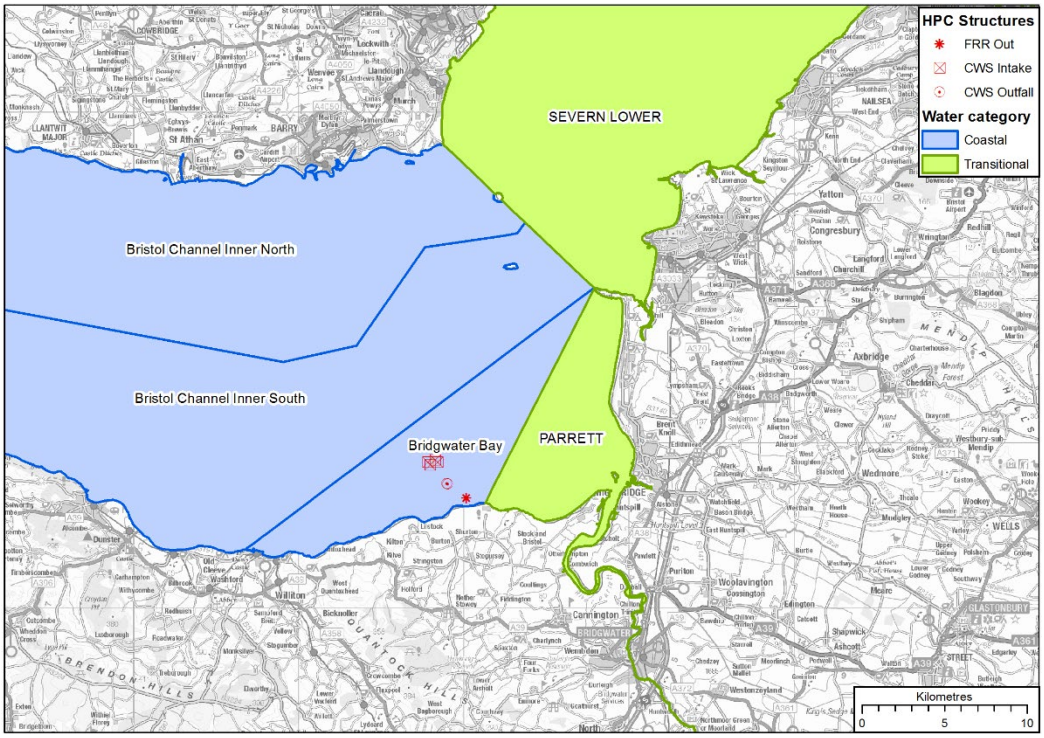


Figure 3 Location of FRR system outlet point and WFD water bodies

Figure 4 shows the predicted fate of sprat exiting the FRR system, based on a 14-day simulation assuming that they are discharging continuously over this period. Sprat are a delicate fish and are not expected to survive the journey through the FRR system. The red dots represent active sprat matter, which are assumed to be at the sea surface, the blue dots are sprat matter that will be consumed by birds at sea (and therefore will not be present in reality). The green dots represent sprat matter that will be beached on the intertidal and saltmarsh habitats, over the course of the 14-day simulation, but most were then modelled to be consumed rapidly by birds. This is represented in the following bullet list (taken from Table 5 of NNB GenCo, 2020b; TR479), which provides a summary of the proportion of sprat for five particles states (alive, sink immediately, sink within 24 hours, eaten, beached) at the end of the 14-day simulation.

- sprat still active at the sea surface: 1,224 particles, 0.44% of population (particles)
- sprat that sink immediately: 249,242 particles, 88.63% of population (particles)
- sprat that sink within 24 hours: 23,967 particles, 8.52% of population (particles)
- sprat eaten at sea: 6,444 particles, 2.29% population (particles)
- total number of sprat beached over the 14 days, but most were then consumed rapidly by birds: 342 particles, 0.12% of population (particles)
- total sprat modelled: 281,219 particles

Only a small percentage of sprat matter (0.12%) is expected to beach, with the expectation that the matter would then be scavenged rapidly. NNB GenCo (2020b; TR479) predicted that even during the peak impingement event (148 beached sprat in one night) the average density along the shoreline was only one sprat per 68m, rapidly falling to zero within 5 hours once bird predation started.

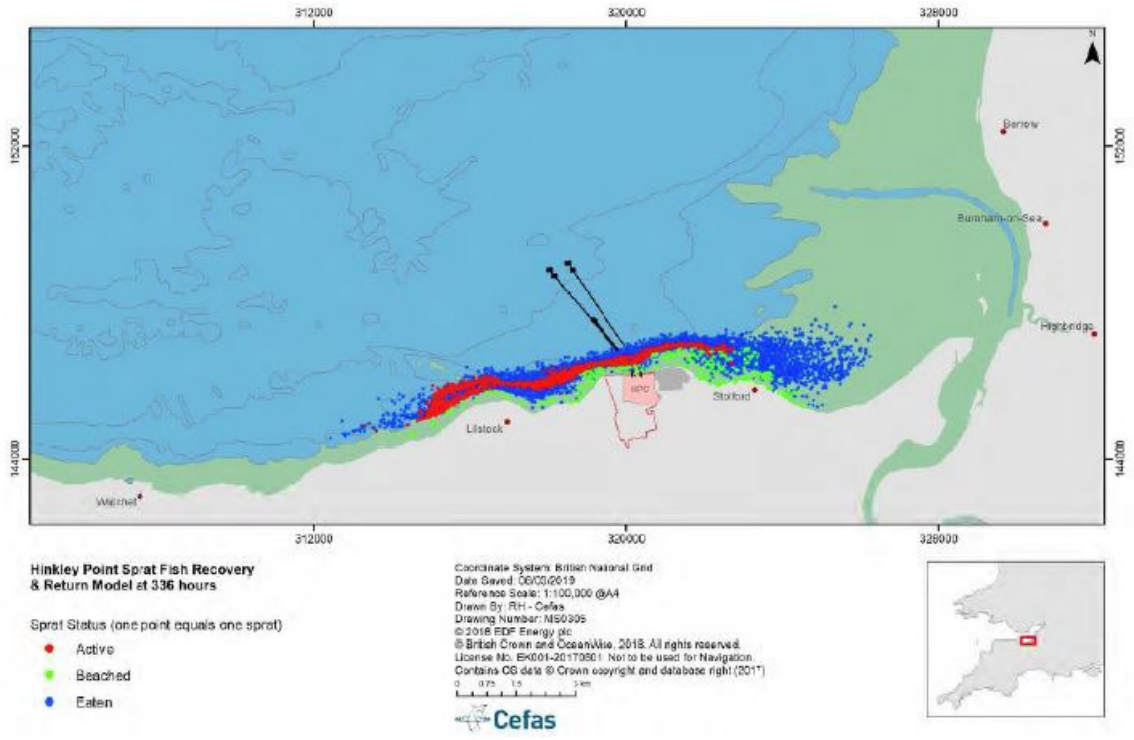


Figure 4 Final positions of active particles (including those which have sunk - red) and the cumulative distribution of beached (green) and eaten by birds (blue) particles over the 14-day simulation. This is Figure 6 in NNB GenCo, 2020b; TR479

9.2.1. Smothering

There is the potential of smothering of the Annex I protected habitats of the Severn Estuary SAC and Severn Estuary Ramsar through the discharge and settling of dead and dying biota.

When carrying out WFD assessments, sensitive habitat is considered to be at risk of an effect from smothering and habitat loss where one or more of the following tests are met and the footprint is:

- 0.5km² or larger
- 1% or more of the water body's area
- within 500m of any higher sensitivity habitat
- 1% or more of any lower sensitivity habitat

Adopting this approach for our appropriate assessment has been agreed with the SNCBs as best practice for determining whether there will be an adverse effect or not.

WFD guidance (Environment Agency, 2016) categorises habitats into higher and lower sensitivity categories, which will be used to assign sensitivities to the relevant Severn Estuary SAC habitats.

Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures, whereas lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C).

WFD higher sensitivity habitats and corresponding Severn Estuary habitats

- chalk reef = reef
- clam, cockle and oyster beds = mudlfats and sandflats
- intertidal seagrass = hard substrate (rocky shores including eel grass beds)
- maerl = subtidal sandbanks
- mussel beds, including blue and horse mussel = reef
- polychaete reef = reef
- saltmarsh = Atlantic saltmeadows
- subtidal kelp beds = subtidal sandbanks
- subtidal seagrass = hard substrate (rocky shores including eel grass beds)

WFD lower sensitivity habitats and corresponding Severn Estuary habitats

- cobbles, gravel and shingle = reefs and hard substrate (rocky shores including eel grass beds)
- intertidal soft sediments like sand and mud = intertidal mudflats and sandflats
- rocky shore = hard substrate (rocky shores including eel grass beds)
- subtidal rocky reef = reef
- subtidal soft sediments like sand and mud = intertidal mudflats and sandflats

The first two steps of the methodology are relevant to all habitat types. The predicted footprint of fish matter from the FRR system is estimated to be more than 0.5km², covering an area of 11.3km². The area of the Severn Estuary SAC is 737km² the footprint of the FRR system fish matter discharge is therefore less than 1% of this area.

The remaining steps will be carried out as part of the habitat specific assessment below. The criteria used will be dependent on whether they are of higher sensitivity (low

resistance to, and recovery rate from, human pressures), or of lower sensitivity (medium to high resistance to, and recovery rate from, human pressure).

Where habitats are identified that cannot be screened out using the criteria above, further assessment will be carried out to determine if it will be possible to conclude no adverse effect on site integrity. The findings of the WFD assessment (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C) will be used to inform this HRA.

9.2.2. Habitat loss

There is the potential of indirect loss to the Annex I protected habitats of the Severn Estuary SAC and Severn Estuary Ramsar, and the mobile species that they support and are functionally linked to.

The criteria applied to smothering will also be applied to this assessment of habitat loss, and they will be considered together in the feature specific assessments.

10. Appropriate assessment - alone

Our appropriate assessment will assess the potential for an adverse effect on the integrity of the European sites identified in the likely significant effect assessment (section 8).

The first step of the appropriate assessment is to determine whether it is possible to conclude no adverse effect on site integrity alone from the FRR system discharge. If it is possible to conclude no adverse effect on site integrity alone, an in-combination assessment will be carried out (section 12).

If it is not possible to conclude no adverse effect alone, mitigation measures to remove the adverse effects will be considered. If there is no effective mitigation measures available, the derogation route will be followed as set out in section 4.3.6 of this HRA.

10.1. Severn Estuary SAC

The following is the appropriate assessment alone for the features of the Severn Estuary SAC, the location of which are shown in relation to the FRR system outlet in Figure 5. The assessment will be made against the relevant conservation objectives and information available in the Severn Estuary EMS Regulation 33 package (Natural England and CCW, 2009).

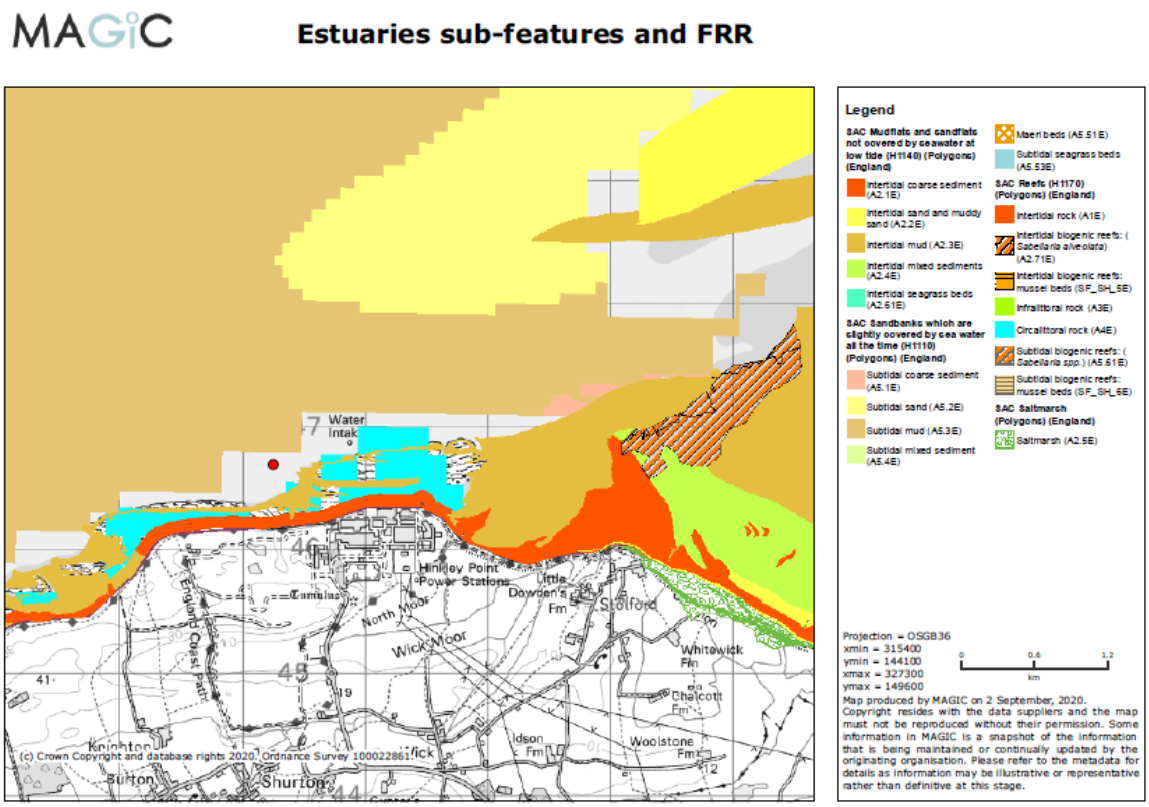


Figure 5 FRR system outlet location (red circle) relative to estuaries sub-features

10.1.1. Annex II fish species

The river lamprey, sea lamprey and twaite shad are Annex II listed features of the Severn Estuary SAC.

Ecological narratives for these species are provided in Appendix 2 of this HRA (Environment Agency, 2023b; Appendix 2).

Conservation objectives

The conservation objective for the river lamprey, sea lamprey and twaite shad features of the Severn Estuary SAC is to maintain the feature as a whole in a favourable conservation status.

The feature will be in favourable condition when, subject to natural processes, following condition relevant to this assessment is met:

- the size of the river lamprey, sea lamprey and twaite shad population within the Severn Estuary and the rivers draining into it is at least maintained and is at a level that is sustainable in the long term
- toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives

Toxic contamination

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“A decrease in water quality within the Estuary may impede the migration of these fish to their spawning grounds in the rivers. Poor water quality may also affect their supply of food. Shad require a good supply of small crustacean prey species, especially mysids and small fish (particularly clupeids). At sea, river lamprey feed on a variety of small fish such as clupeids, whilst sea lamprey feed on larger fish including Atlantic salmon. Pollution tolerance levels of shad and lamprey are unknown, but EA water quality policy is that levels should comply with targets established under the EA Review of Consents and the Water Framework Directive.”

In addition to the direct effects of toxic contamination, the Regulation 33 package also lists changes in oxygenation as a risk to the feature:

“A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition, occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary. Shad and lamprey may therefore be vulnerable to changes in oxygenation given the high exposure to changes resulting from operations within the Estuary.”

The largest mixing zone to assess toxic contamination against is 9.78m² for unionised ammonia, and 0.064km² being needed to meet the oxygen demand through reaeration, as given in Toxic Contamination methodology section above. These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

It is considered that this mixing zone is inconsequential when compared against the Severn Estuary SAC, which covers an area of 737km².

Toxic contaminants in the water column are expected to meet their EQS within a small mixing zone and are not expected to risk the conservation objectives of the Severn Estuary SAC.

The small area of EQS exceedance is unlikely to impact upon the passage of the Annex II species through the Severn Estuary for spawning. The mixing zone is located close to the shore and doesn’t extend into the estuary. Figure 2 indicates that the mixing zone for the discharge is likely to be elliptical, running parallel to the shore.

Conclusion: toxic contamination

It is therefore possible to conclude **no adverse effect** on site integrity alone for the Annex II fish features of the feature of the Severn Estuary SAC, river lamprey, sea lamprey and twaite shad, when considering the effects of toxic contamination.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“It is possible that changes in nutrient levels may affect the food supply of the shad and lamprey. However, due to the natural high turbidity of the system and the volumes of water involved, it is thought that any effects would be minimal.”

The largest mixing zone to assess nutrient enrichment against is 0.56km² for organic enrichment, as given in section 9.1 “Methodology: nutrient enrichment and toxic contamination” of this report. These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

It is considered that this mixing zone is inconsequential when compared against the European site, which covers an area of 737km².

The small area of area affected by organic enrichment is unlikely to impact upon the food supply of the river lamprey, sea lamprey and twaite shad.

Conclusion: nutrient enrichment

It is therefore possible to conclude **no adverse effect** on site integrity alone for the for the Annex II fish features of the feature of the Severn Estuary SAC, river lamprey, sea lamprey and twaite shad, when considering the effects of nutrient enrichment and the advice provided in the Regulation 33 (Natural England and CCW, 2009) package.

Smothering and habitat loss

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The estuary habitats, tidal stretches of the feeding rivers and saltmarsh morphological features such as drainage channels, known locally as “pills” and “rhines” (“reens” in Wales) provide important feeding, breeding and sheltered nursery areas for a wide range of fish.”

Table 22 of the Regulation 33 package indicates that the Annex II species of the SAC have a low vulnerability to direct effects of smothering, with no detectable sensitivity and low exposure.

The indirect effects on the saltmarsh habitats will therefore be considered as part of this assessment.

The assessment of the Atlantic salt meadows Annex I habitat above concluded that even when considering the elevated predicted discharge of fish material from the FRR system, it would result only in minor impacts on benthic assemblages of the saltmarsh habitat at a scale that would not be likely to result in an adverse effect on site integrity.

Conclusion: smothering and habitat loss

This allows for a conclusion of **no adverse effect** on site integrity alone, when considering the effects of smothering and indirect habitat and prey species loss on the Severn Estuary SAC.

10.1.2. Conclusion Annex II fish species appropriate assessment alone

It is therefore possible to conclude **no adverse effect** alone on the Annex II fish species of the Severn Estuary SAC.

An in-combination assessment is required.

10.1.3. Subtidal sandbanks

“Subtidal sandbanks” are an Annex I habitat interest feature of the Severn Estuary SAC.

As stated in the ecological narrative for this feature (Environment Agency, 2023b, Appendix 2), the subtidal sandbanks feature is slightly covered by sea water all the time, typically at depths of less than 20m below chart datum (but sometimes including channels or other areas greater than 20m deep). The closest point of the feature to the FRR system outlet is approximately 100m.

The sub-features of the “subtidal sandbanks” feature of the SAC are:

- sublittoral cohesive mud and sandy mud communities
- sublittoral sands and muddy sand communities

The conservation objective for the “subtidal sandbanks” feature of the Severn SAC is to maintain the feature in favourable condition, the full objectives can be accessed in via this link: http://publications.naturalengland.org.uk/file/3977366.

The feature will be in favourable condition when, subject to natural processes, each of the following relevant conditions are met:

- the total extent of the subtidal sandbanks within the site is maintained
- the extent and distribution of the individual subtidal sandbank communities within the site is maintained
- the community composition of the subtidal sandbank feature within the site is maintained

“Subtidal sandbanks” are at risk from toxic contamination, nutrient enrichment, smothering and habitat loss, there is the potential that these risks could affect the communities supported by the feature.

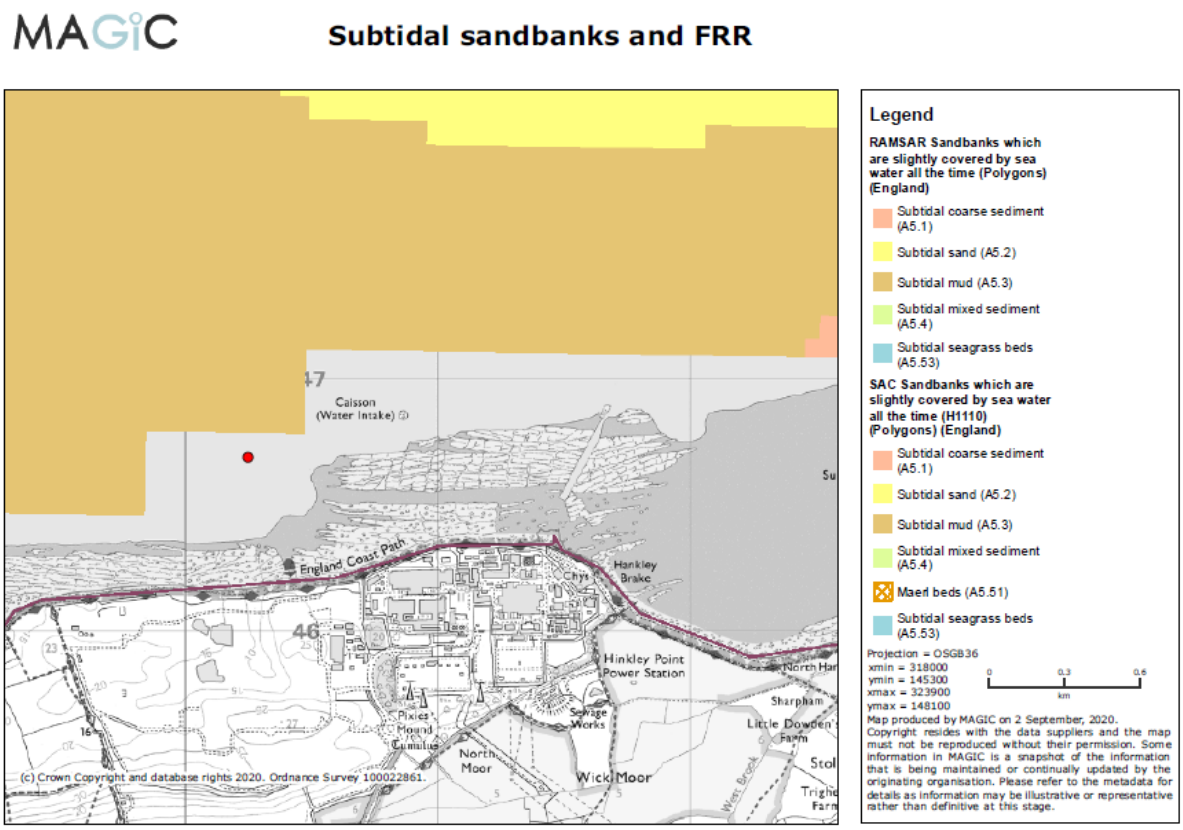


Figure 6 FRR system outlet location (red circle) relative to "subtidal sandbanks"

Toxic contamination

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

"The subtidal sandbanks feature is currently considered to have moderate sensitivity and high exposure and therefore high vulnerability to toxic contamination.

As a result of the domination of physical conditions within the Estuary, for the majority of biological communities there is little unequivocal evidence of additional impact due to contaminants across the Estuary as a whole. Individual populations may have been impacted close to major discharges however."

In addition to the direct effects of toxic contamination, the Regulation 33 package also lists changes in oxygenation as a risk to the feature:

"The subtidal sandbanks feature is currently considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition, occasional intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary.

Oxygen-deficient marine areas are characterized by a decline in the number and diversity of species. Certain communities occurring within the Estuary's subtidal sandbanks are

moderately sensitive to decreases in dissolved oxygen levels. However, recoverability of these areas should be rapid upon return to normal conditions."

The largest mixing zone to assess toxic contamination against is 9.78m² for unionised ammonia, and 0.064km² being needed to meet the oxygen demand through reaeration (refer to section 9.1). These predicted mixing zones do not consider tidal dispersion of the discharged matter and consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative worst-case and acute impact scenario scenarios (refer to section 9.1).

The nearest point of the subtidal sandbanks feature of the Severn Estuary SAC and Severn Estuary Ramsar is approximately 100m from the FRR system discharge point (as indicated by the red circle in Figure 2). The mixing zone is predicted to be elliptical in shape, running parallel to the coast (Figure 2), whilst there is the potential for an overlap between the sub-tidal sandbanks and the discharge footprint, it is not expected to be at a scale that would lead to an adverse effect on the feature, which covers an area of 117km² within the SAC. In addition, the calculation of the mixing zones does not consider the consumption of the discharged matter by detritivores and scavengers, the seasonality of the discharge, nor does it take account of the dynamic nature of the Severn Estuary.

Conclusion: toxic contamination

It is therefore possible to conclude **no adverse effect** on site integrity alone for the "subtidal sandbanks" feature of the Severn Estuary SAC.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

"The subtidal sandbanks feature is currently considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in nutrient loading

Whilst nutrient levels and loadings within the Estuary are considered significant in UK terms the high natural turbidity of the system negates these high levels, with algal productivity being generally low except in localised hotspots. Where these do occur, nutrient enrichment may lead to significant shifts in community composition on/in subtidal sandbanks but recoverability is likely to be high."

The largest mixing zone to assess nutrient enrichment against is 0.56km² the area affected by carbon enrichment, refer to section 9.1 of this report. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and is therefore conservative worst-case and acute impact scenario.

The nearest point of the "subtidal sandbanks" feature of the Severn Estuary SAC and Severn Estuary Ramsar is approximately 100m from the FRR system outlet (as indicated by the red circle in Figure 6). The mixing zone is predicted to be elliptical in shape, running

parallel to the coast (Figure 2). With a required conservative mixing zone of 0.56km2, there is the potential for overlap with the feature.

As stated in the Regulation 33 package, the Severn Estuary is highly turbid, with algal productivity generally being low. The area that the FRR discharges into is not considered to be a hotspot for algal growth, the WFD assessment identified the phytoplankton status of Bridgwater Bay as being 'moderate', but also concluded that discharge of dead matter from the FRR system will not result in deterioration of WFD status at the water body scale because of impacts on water quality (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C).

We do not consider that the Bridgwater Bay is hotspot for algal growth. The dynamic combined phytoplankton macroalgae model used in TR515 (NNB GenCo, 2020a; TR515) to assess the potential for increased phytoplankton production only looks at chlorophyll production and due to the high turbidity does not predict an increase in production due to the increase in nutrients. TR515 estimates an uplift in the dissolved inorganic nitrogen (DIN) and phosphate in the daily tidal exchange of Bridgwater Bay of less than 0.1% from the total of the operational HPC including the FRR discharge. Even with our more conservative estimates, this would still be an insignificant increase in nutrients and unlikely to cause an impact.

The favourable condition table for the "subtidal sandbanks" feature (Table 9, Natural England and CCW, 2009) has a target for "No decline in community quality due to changes in species composition or loss of typical species from an established baseline subject to natural processes".

There is the potential that scavengers attracted to the discharge from the FRR system outlet could result in changes to species composition of the "subtidal sandbanks". An assessment of the dispersal of sprat following discharge from the FRR was conducted by the applicant (NNB GenCo, 2020b; TR479)[3]. This assessment predicted that the currents in the vicinity of HPC will distribute material discharged from the FRR along an approximately 12 km stretch of coastline as shown in Figure 4.

It is the possible that this 12km length of coastline, which includes "subtidal sandbanks" habitat, may have an increase in crab and starfish numbers. However, when compared to the area of "subtidal sandbanks" within the SAC of 1,300 hectares (13km²) it is very unlikely that this increase in scavengers would lead to changes in species composition of the "subtidal sandbanks" feature as a whole.

[3] Sprat were assessed on the basis of them being the numerically-dominant contributors to discharged fish matter

Conclusion

It is therefore possible to conclude **no adverse effect** alone for the subtidal sandbanks feature of the Severn Estuary SAC.

Smothering and habitat loss

“Subtidal sandbanks” are a lower sensitivity habitat with a low vulnerability to smothering and habitat loss (Table 22, Regulation 33 Package (Natural England and CCW, 2009)).

The approximate area of the more permanent subtidal sandbanks within the Severn Estuary SAC is 1,300 hectares (13km²) and there are approximately 10,440 hectares (104km²) of associated ephemeral sandbanks. The total predicted footprint from the FRR system is 11.3km², covering an area within the Bridgwater Bay and River Parrett WFD water bodies.

Whilst there is the potential for an overlap between the sub-tidal sandbanks and the discharge footprint, the risk to the feature of smothering and habitat loss is low. The calculation of the footprints does not take into consideration the consumption of the discharged matter by detritivores and scavengers, the seasonality of the discharge, nor does it take account of the dynamic nature of the Severn Estuary.

The rate of discharge from the FRR system is also seasonal, the month with the highest total dead biomass of all fish plus invertebrate species is expected to be December (489.4kg). At other times of the year the rate of discharge used in this assessment is expected to be lower, with the spring months March to May and October predicted to have the lowest rates of discharge. Table 6 in Environment Agency, 2023d; AR001 predicts that there will be a daily total of 241.9kg of matter discharged from the FRR system based on the most abundant fish expected to be entrained at HPC December compared to a daily low of 44kg in October.

An assessment of the dispersal of sprat following discharge from the FRR was conducted by the applicant (NNB GenCo, 2020b; TR479)[4]. This assessment predicted that the currents in the vicinity of HPC will distribute material discharged from the FRR along an approximately 12 km stretch of coastline, with little potential of the material settling on and smothering the subtidal sandbanks (Figure 4). The model predicts that 88% of the particles would sink immediately close to the FRR system outlet and be consumed by detritivores and fish. Of the remaining matter, a further 8% would sink within 12 hours, the remaining small percentage being eaten by birds or beached along the coastline.

[4] Sprat were assessed on the basis of them being the numerically-dominant contributors to discharged fish matter

The proportion of matter sinking on discharge is high but will in reality be dispersed over a large area due to the dynamic nature of the Severn and be scavenged by detritivores, with little potential to smother the subtidal sandbanks.

They are located off-shore (Figure 6) where the dynamic tidal influence will ensure that there is no potential for any discharge of biomass from the FRR system to settle and smother the sandbanks, resulting in habitat loss.

Conclusion

It is therefore possible to conclude **no adverse effect** alone on the “subtidal sandbank” interest feature of the Severn Estuary SAC from smothering and habitat loss

10.1.4. Conclusion - subtidal sandbanks appropriate assessment alone

It is therefore possible to conclude **no adverse effect** alone on the “subtidal sandbanks” feature of the Severn Estuary SAC.

An in-combination assessment is required.

10.1.5. Intertidal mudflats and sandflats

Intertidal mudflats and sandflats are an Annex I habitat interest feature of the Severn Estuary SAC and sub-feature of the estuaries SAC interest feature.

As stated in the ecological narrative for this feature (Environment Agency,2023b; Appendix 2), intertidal mudflats and sandflats are submerged at high tide and exposed at low tide, covering an area of 203km² within the Severn Estuary SAC and Severn Estuary Ramsar. The closest point of the feature to the FRR system outlet is approximately 200m.

The sub-features of the “intertidal mudlfats and sandflats” are:

- intertidal mud communities
- intertidal muddy sand communities
- intertidal gravel and clean sand communities

The conservation objective for “mudflats and sandflats” feature of the Severn Estuary SAC is to maintain the feature in favourable condition, the full objectives can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

The feature will be in favourable condition when, subject to natural processes, each of the following relevant conditions are met:

- the total extent of the mudflats and sandflats feature is maintained
- the variety and extent of individual mudflats and sandflats communities within the site is maintained
- the distribution of individual mudflats and sandflats communities within the site is maintained
- the community composition of the mudflats and sandflats feature within the site is maintained

“Intertidal mudflats and sandflats” are at risk from toxic contamination, nutrient enrichment, smothering and habitat loss. There is the potential that these risks could affect the communities supported by the feature.

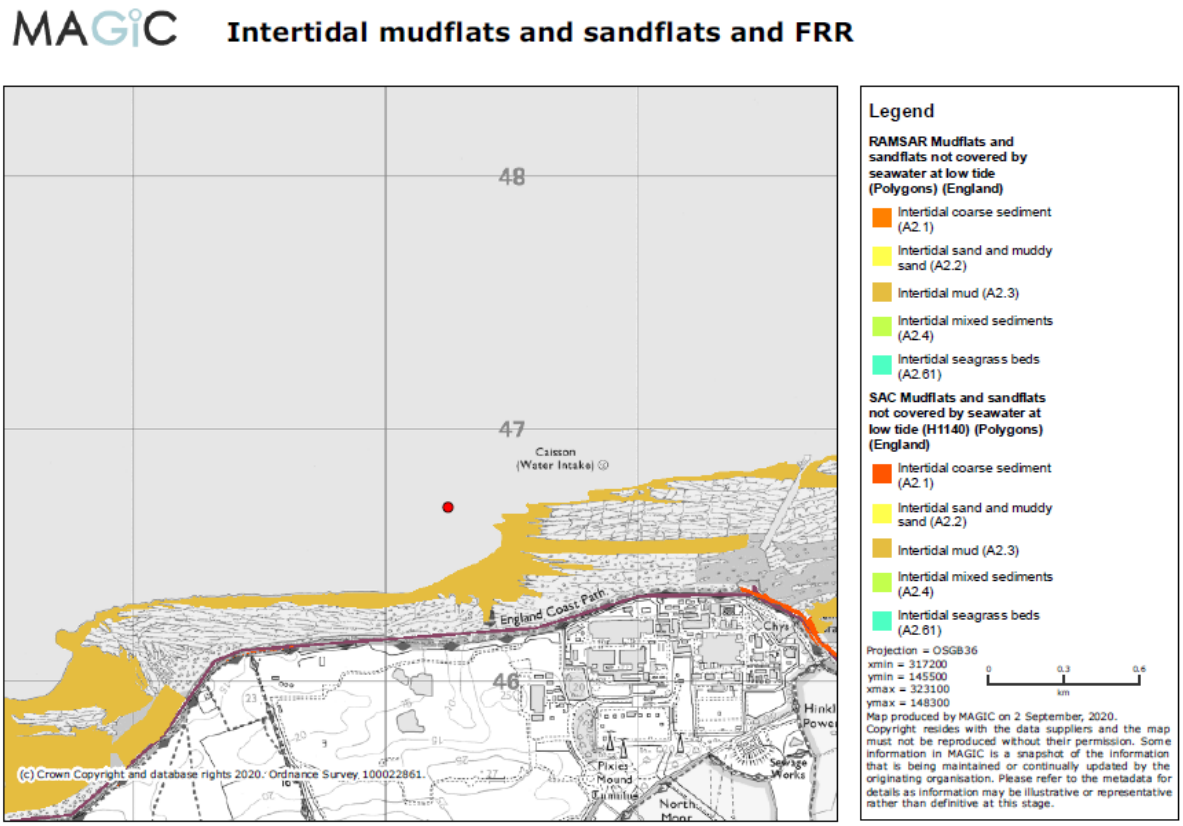


Figure 7 FRR system outlet location (red circle) relative to “intertidal mudflats and sandflats”

Toxic contamination

The Regulation 33 (Natural England and CCW, 2009) package for the Severn Estuary EMS states that:

“The intertidal mudflats and sandflats feature is currently considered to have high sensitivity and high exposure and therefore high vulnerability to toxic contamination by synthetic and non-synthetic compounds.

Overall vulnerability to all toxic contamination is considered ‘high’ (due to the exposure from sewage inputs being classed as ‘high’ and also with ‘moderate’ levels from industrial inputs etc.).”

In addition to the direct effects of toxic contamination, the Regulation 33 package also lists changes in oxygenation as a risk to the feature:

“The intertidal mudflats and sandflats feature is currently considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition, occasional intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary.

Oxygen-deficient marine areas are characterized by a decline in the number and diversity of species. Certain communities occurring within the Estuary's intertidal mudflats and sandflats are moderately sensitive to decreases in dissolved oxygen levels. However, recoverability of these areas should be rapid upon return to normal conditions."

The largest mixing zone to assess toxic contamination against is 9.78m² for unionised ammonia, and 0.064km² being needed to meet the oxygen demand through reaeration, as described in section 9.1.1 of this report. These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

The nearest point of the intertidal mudflats and sandflats feature of the Severn Estuary SAC and Severn Estuary Ramsar is approximately 200m from the FRR system discharge point (as indicated by the red circle in Figure 7). The mixing zone is predicted to be a narrow elliptical shape, running parallel to the coast (Figure 2), with little potential for an overlap between the intertidal mudflats and sandflats and the mixing zone. In addition, the calculation of the mixing zones does not take into consideration the consumption of the discharged matter by detritivores and scavengers, which is expected to be rapid, nor does it take account of the dynamic nature of the Severn Estuary.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the "intertidal mudflats and sandflats" feature of the Severn Estuary SAC from the effects of toxic contamination.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

"The intertidal mudflats and sandflats feature is currently considered to have moderate sensitivity and high exposure and therefore high vulnerability to changes in nutrient loading.

The most obvious sign of an increase in nutrient loading (or organic enrichment) on mudflats is the lush growth of green seaweeds on the surface. Such increases coupled with reduced oxygenation typically lead to anaerobic conditions predominating within the sediment. Moderate organic enrichment does provide food which can enhance species diversity but with greater enrichment, the diversity declines and the community becomes increasingly dominated by a few, pollution tolerant, opportunistic species such as the polychaete Capitella capitata.

In sandier sediments where particle size is greater, the effects of an increase in organic enrichment are less dramatic. However, the structure of the community is still likely to change from one dominated by suspension feeders to one favouring deposit feeders, accompanied by an increase in the abundance of opportunistic species and a decrease in species richness. Note, however, that the high natural turbidity of the system negates many of these effects, and algal productivity is generally low except in localised hotspots."

The largest mixing zone to assess nutrient enrichment against is 0.56km² the area affected by carbon enrichment, as given in section 9.1.2 of this report. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

The nearest point of the intertidal mudflats and sandflats feature of the Severn Estuary SAC and Severn Estuary Ramsar is approximately 200m from the FRR system outlet (as indicated by the red circle in Figure 7). The shape and position of the mixing zone is unlikely to overlap with the intertidal habitats.

As stated in the Regulation 33 package, the Severn Estuary is highly turbid, with algal productivity generally being low. The area of Bridgwater Bay that the FRR discharges into is not considered to be a hotspot for algal growth, the WFD assessment identified the phytoplankton status of the bay as being 'moderate' (refer to section 10.1.3, "subtidal sandbanks" nutrient enrichment assessment), but also concluded that discharge of dead matter from the FRR system will not result in deterioration of WFD status at the water body scale because of impacts on water quality (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C).

The favourable condition table for the "intertidal mudflats and sandflats" feature (Table 9, Natural England and CCW, 2009) has a target for "No decline in community quality due to changes in species composition or loss of typical species from an established baseline subject to natural processes".

There is the potential that scavengers attracted to the discharge from the FRR system outlet could result in changes to species composition of the "intertidal mudflats and sandflats". An assessment of the dispersal of sprat following discharge from the FRR was conducted by the applicant (NNB GenCo, 2020b; TR479)[5]. This assessment predicted that the currents in the vicinity of HPC will distribute material discharged from the FRR along an approximately 12 km stretch of coastline as shown in Figure 4.

It is the possible that this 12km length of coastline, which includes "subtidal sandbanks" habitat, may have an increase in crab and starfish numbers. However, when compared to

[5] Sprat were assessed on the basis of them being the numerically-dominant contributors to discharged fish matter

the area of “subtidal sandbanks” within the SAC of 203km² it is very unlikely that this increase in scavengers would lead to changes in species composition of the “intertidal mudflats and sandflats” feature of the Severn Estuary SAC.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the intertidal mudflats and sandflats feature of the Severn Estuary SAC from the effects of nutrient enrichment.

Smothering and habitat loss

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The intertidal mudflats and sandflats feature is considered to have moderate sensitivity and moderate exposure and therefore moderate vulnerability to smothering.”

Smothering of organisms is likely to occur because of the direct deposition of material on top of them and/or on their habitat.

The discharge point is within the 500m screening distance of the interest feature, at 200m from the mudflats of Bridgwater Bay.

It is predicted that material discharged from the FRR will potentially settle in an area characterised by intertidal soft sediments. Approximately 3.3 km² of this habitat is likely to be covered of 203km² designated within the SAC, which is more than 1% of the designated habitat.

An assessment of the dispersal of sprat following discharge from the FRR was conducted by the applicant (NNB GenCo, 2020b; TR479). This assessment predicted that the currents in the vicinity of HPC will distribute material discharged from the FRR along an approximately 12 km stretch of coastline, as set out in section 9.2 of this report.

The assessment is based upon the highest predicted discharge of matter occurring in December being applied across the year, whereas there will be fluctuations in the volume of the discharge. TR515 (NNB GenCo, 2020a; TR515) predicted that the lowest rate of discharge would occur in the spring months March to May and October, this is not accounted for in the assessment. Table 6 in Environment Agency, 2023d; AR001), predicts that there will be a daily total of 242kg of matter discharged from the FRR system (December), compared to a daily low of 44kg in October.

Figure 4 indicates that matter from the FRR system is predicted to be beached on the intertidal habitat. However, based on the particle tracking model, this is likely to be only a small percentage of the outlet and is expected to be consumed rapidly by scavenging gulls once beached. Any impact will be short lived and is not expected to result in smothering of the habitat or habitat loss.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the "intertidal mudflats and sandflats" feature of the Severn Estuary SAC.

10.1.6. Conclusion – intertidal mudflats and sandflats appropriate assessment alone

It is therefore possible to conclude **no adverse effect** alone on the "intertidal mudflats and sandflats" feature of the Severn Estuary SAC.

An in-combination assessment is required.

10.1.7. Atlantic salt meadows

"Atlantic salt meadows" is an Annex 1 habitat interest feature of the Severn Estuary SAC.

As stated in the ecological narrative for this feature (Annex 3), the Severn Estuary is fringed by saltmarsh. The huge tidal range in the Severn Estuary has led to extensive saltmarsh community development with an expanded zonation. The closest point of the feature to the FRR system outlet is approximately 2.8km (Figure 24).

The sub-features of the "Atlantic salt meadows" are:

- low-mid marsh communities
- mid-upper marsh communities
- transitional high marsh communities
- pioneer saltmarsh communities

The conservation objective for the "Atlantic salt meadow" feature of the Severn Estuary SAC is to maintain the feature in favourable condition, the full objectives can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

The feature will be in favourable condition when, subject to natural processes, each of the following conditions are met:

- the total extent of Atlantic salt meadow and associated transitional vegetation communities within the site is maintained
- the extent and distribution of the individual Atlantic salt meadow and associated transitional vegetation communities within the site is maintained
- the zonation of Atlantic salt meadow vegetation communities and their associated transitions to other estuary habitats is maintained
- the relative abundance of the typical species of the Atlantic salt meadow and associated transitional vegetation communities is maintained
- the abundance of the notable species of the Atlantic salt meadow and associated transitional vegetation communities is maintained

Atlantic salt meadows are at risk from toxic contamination, nutrient enrichment, smothering and habitat loss. There is the potential that these risks could affect the communities supported by the feature.

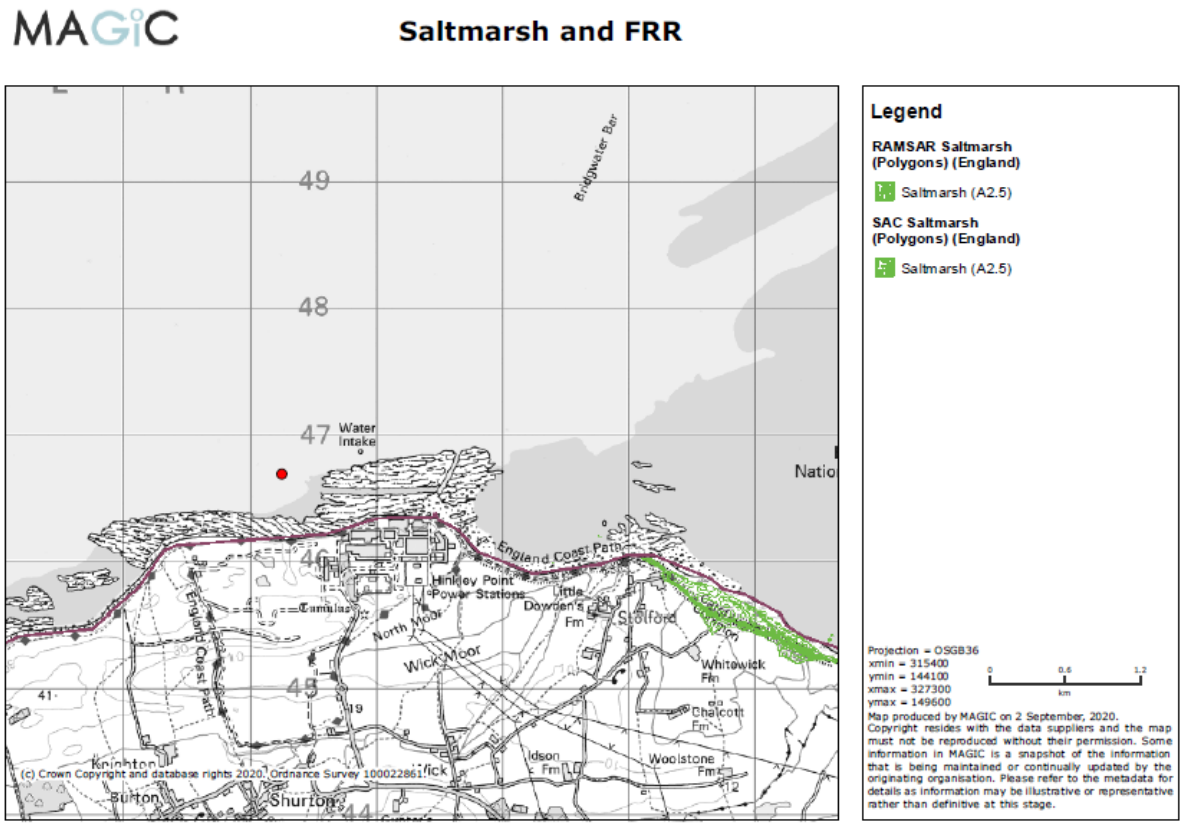


Figure 8 FRR system outlet location (red circle) relative to "Atlantic salt meadow"

Toxic contamination

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

"The Atlantic salt meadows and their associated communities feature is currently considered to have moderate to high sensitivity and high exposure and therefore high vulnerability to toxic contamination from both synthetic and non-synthetic compounds.

In addition to the direct effects of toxic contamination, the Regulation 33 package also lists changes in oxygenation as a risk to the feature.

The Atlantic salt meadows and their associated communities feature is currently considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition, occasional intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary."

The largest mixing zone to assess toxic contamination against is 9.78m² for unionised ammonia, and 0.064km² being needed to meet the oxygen demand through reaeration, as given in the methodology section above. These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

The nearest point of the “Atlantic salt meadows” feature of the Severn Estuary SAC is at least 3km from the FRR system outlet (as indicated by the red circle in Figure 8). At this distance the discharge will be fully dispersed to levels well below the EQS, and at a level that will not result in toxic contamination. An indication of the mixing zone is given in Figure 2.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the Atlantic salt meadows feature of the Severn Estuary SAC from the effects of toxic contamination.

The Atlantic salt meadows sub-feature of the estuaries interest feature of the Severn Estuary SAC is **not a habitat of concern** from the effects of toxic contamination.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The Atlantic salt meadows and their associated communities feature is currently considered to have moderate sensitivity and high exposure and therefore high vulnerability to changes in nutrient loading.

The Estuary’s saltmarshes and associated communities are thought to be more susceptible to nutrient enrichment than was previously realised, so they have been assessed as being of high sensitivity to increases in nutrient loading and/or organic enrichment. However, increased growth of certain seaweed species may result from elevated levels of nitrates and phosphates and cause local smothering which is known to have a detrimental effect on glasswort (Salicornia spp.) in low marsh communities. In addition, the species composition of the plants on the saltmarsh may be altered by changes in nutrient loading leading to a change in the structure of the sward.”

The largest mixing zone to assess nutrient enrichment against is 0.56km² the area affected by carbon enrichment, as given in Nutrient Enrichment methodology section above. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

The nearest point of the Atlantic salt meadows feature of the Severn Estuary SAC is at least 3km from the FRR system outlet (as indicated by the red circle in Figure 8). At this distance the discharge will be fully dispersed to levels well below those that will result in nutrient enrichment. An indication of the mixing zone is given in Figure 2.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the "Atlantic salt meadows" feature of the Severn Estuary SAC from the effects of nutrient enrichment.

Smothering and habitat loss

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

"The Atlantic salt meadows feature is considered to have high sensitivity and moderate exposure and therefore high vulnerability to smothering.

Smothering of saltmarsh is likely to occur as a result of the direct deposition of material on the surface. This can happen by either direct deposition of materials on land or through silt-laden tides. The saltmarshes of the Severn are subject to spring tides each year which can in some locations deposit a thick layer of sediment on the surface which can persist for some months. Normally the level of this natural deposition is compatible with the speed of vertical accretion and growth of the saltmarsh. Higher levels of sediment deposition which may be associated with development activities (increasing sediment suspension) can cause smothering to occur resulting in loss of vegetation or shifts in community composition and zonation."

The nearest point of the Atlantic salt meadows feature of the Severn Estuary SAC and Severn Estuary Ramsar is located further than the 500m screening distance from the FRR system outlet, at a distance of at least 3km (as indicated by the red circle in Figure 8).

The assessment is based upon the highest predicted discharge of matter occurring in December being applied across the year, whereas there will be fluctuations in the volume of the discharge. NNB GenCo (2020a; TR515) predicted that the lowest rate of discharge would occur in the spring months March to May and October, this is not accounted for in the assessment. Table 6 in Environment Agency (2023d; AR001), predicts that there will be a daily total of 242kg of matter discharged from the FRR system (December), compared to a daily low of 44kg in October.

Figure 4 indicates that matter from the FRR system is predicted to be beached on the Atlantic salt meadow habitat. However, based on the particle tracking model, this is likely to be only a small percentage of the discharge and is expected to be consumed rapidly by scavenging gulls once beached. Any impact will be short lived and is not expected to result in smothering of the habitat or habitat loss.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the "Atlantic salt meadows" feature of the Severn Estuary SAC from the effects of smothering and resultant habitat loss.

10.1.8. Conclusion – Atlantic salt meadows appropriate assessment alone

It is therefore possible to conclude **no adverse effect** alone on the Atlantic salt meadows feature of the Severn Estuary SAC.

An in-combination assessment is required.

10.1.9. Reefs

“Reefs” are an Annex I habitat interest feature of the Severn Estuary SAC and sub-feature of the Estuaries SAC interest feature.

As stated in the ecological narrative for this feature (Environment Agency, 2023b; Appendix 2) the Severn Estuary has areas of biogenic reefs, formed by the tube-dwelling polychaete worm Sabellaria alveolata. Sabellaria reefs in the UK are predominantly an intertidal habitat but the Severn Estuary is one of the few places where Sabellaria reefs occur extensively in the subtidal, as well as the intertidal.

There are patches of intertidal Sabellaria reef throughout the Estuary, although it tends to be more common on the English side. The subtidal Sabellaria tends to be in the outer parts of the Estuary, southwest of a line between Clevedon and Newport.

The conservation objective for the “reefs” feature of the Severn Estuary SAC is to maintain the feature in a favourable condition, the full objectives can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

The feature will be in favourable condition when, subject to natural processes, each of the following conditions are met:

- the total extent and distribution of Sabellaria reef is maintained
- the community composition of the Sabellaria reef is maintained
- the full range of different age structures of Sabellaria reef are present
- the physical and ecological processes necessary to support Sabellaria reef are maintained

Reefs are at risk from toxic contamination, nutrient enrichment, smothering and habitat loss. There is the potential that these risks could affect the communities supported by the feature.

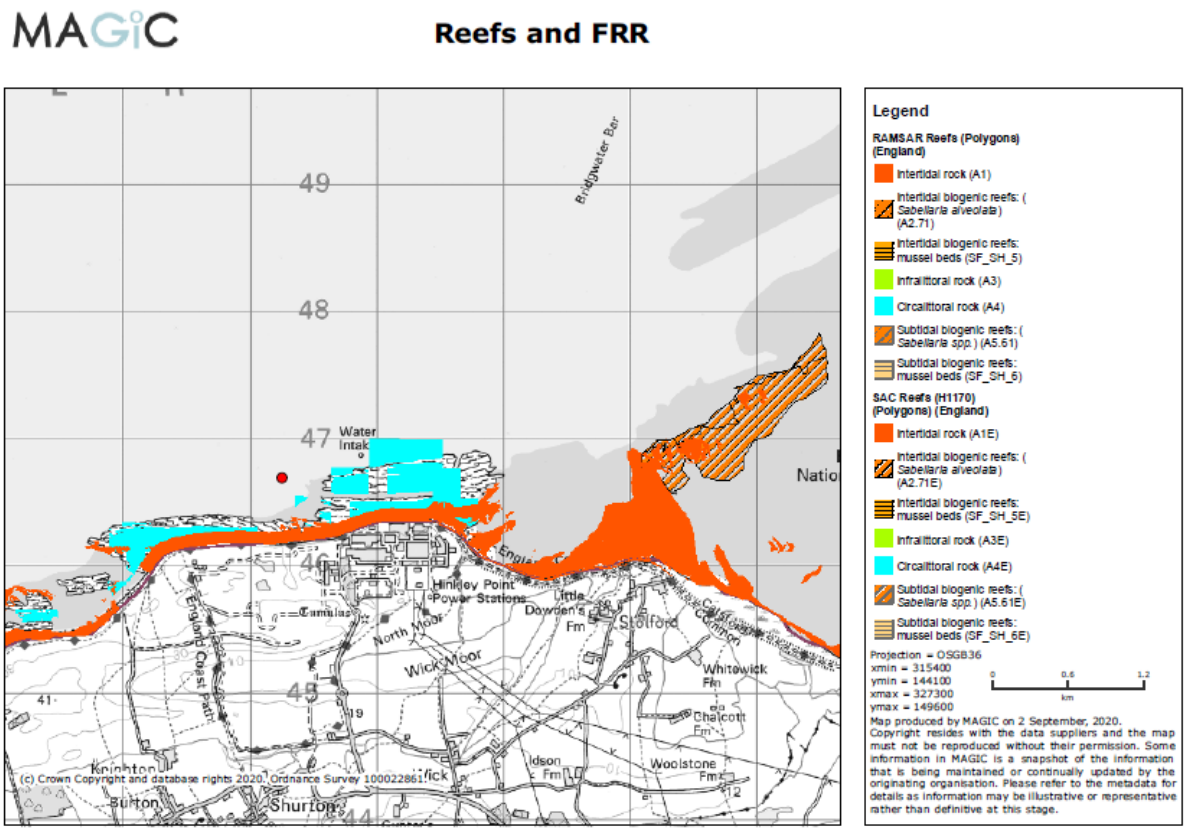


Figure 9 FRR system outlet location (red circle) relative to reefs

Toxic contamination

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The sensitivity of Sabellaria alveolata to toxic contaminants (domestic effluent, industrial effluent, heavy metals, hydrocarbons) entering the water is not known. The precautionary principle should therefore be applied.

The reefs are considered to have high exposure to both synthetic compounds and non-synthetic compounds.

The reefs are therefore moderately vulnerable to the introduction of synthetic compounds and non-synthetic compounds.”

In addition to the direct effects of toxic contamination, the Regulation 33 package also lists changes in oxygenation as a risk to the feature.

“The reefs feature is currently considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition occasional, intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary."

The largest mixing zone to assess toxic contamination against is 9.78m² for unionised ammonia, and 0.064km² being needed to meet the oxygen demand through reaeration (refer to section 9.1.1). These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative worst-case and acute impact scenario scenarios.

The nearest point of the "reefs" feature of the Severn Estuary SAC is approximately 170m to circalittoral rock (which is also a sub-feature of the estuary feature), 300m to intertidal rock and at least 3km to intertidal biogenic reefs and from the FRR system discharge point (as indicated by the red circle in Figure 5). Habitats in Bridgwater Bay are dominated by subtidal soft sediments and subtidal gravel and cobble habitats (**Figure 9**). Areas of rocky shore and subtidal rocky reef are distributed along the intertidal and near-shore subtidal, respectively. No areas of highly sensitive habitats are recorded in Bridgwater Bay.

The exact distribution of subtidal Sabellaria reef in the Severn Estuary is unknown, partly due to the difficulties in sampling this habitat. Results of Hamon grab and anchor dredge sampling for Sabellaria reef in February and March 2010 (NNB GenCo, 2010; TR141) are shown in Figure 10. Open circles indicate stations where no Sabellaria were observed in samples. The reefs to the west of HPC are largely outside of the Severn Estuary SAC. Those within the SAC boundary are in, or close to, the biogenic reef shown in Figure 10.

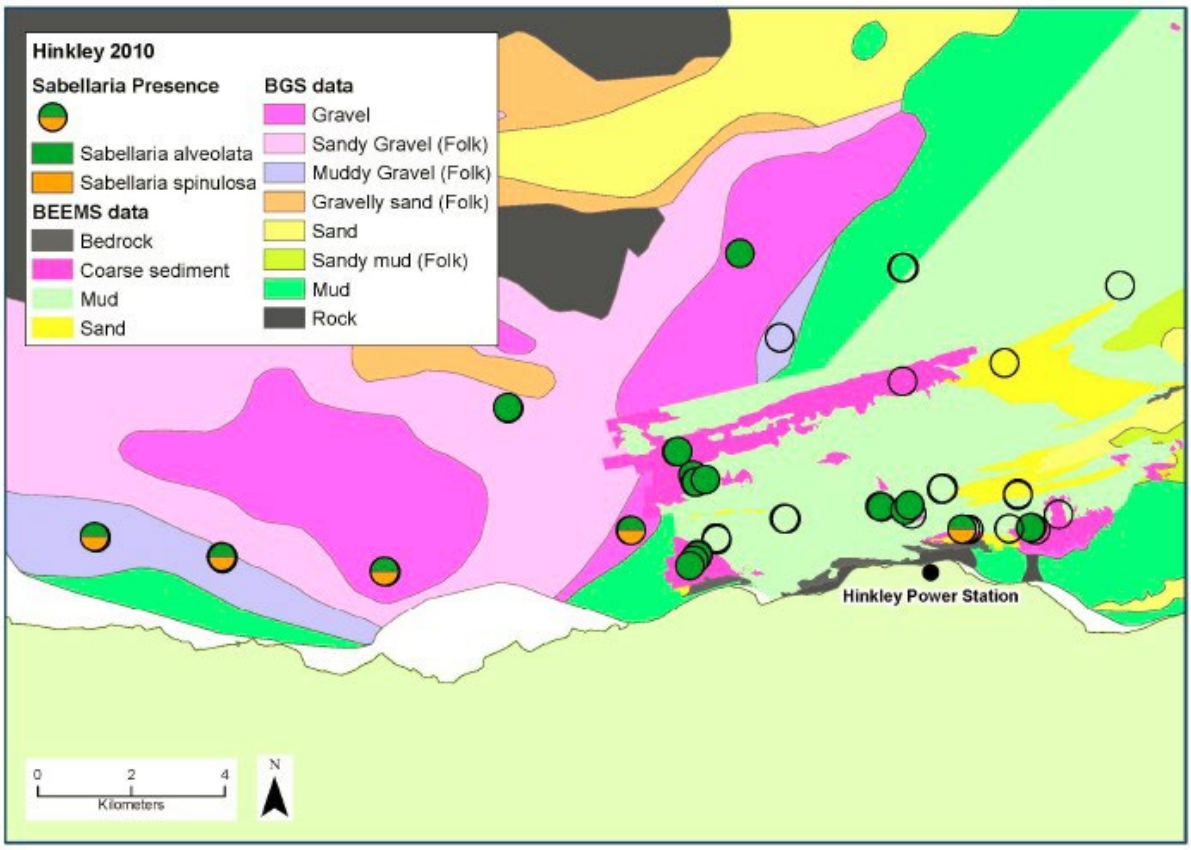


Figure 10 Presence of Sabellaria alveolate (green) and Sabellaria spinulosa (orange) across the Hinkley Point area (Environment Agency, 2013)

The mixing zone is predicted to be elliptical in shape, running parallel to the coast (Figure 2), whilst there is the potential for an overlap between circalittoral and the intertidal rock and the discharge footprint, these habitats are not thought to be highly sensitive to anthropogenic activities.

The intertidal biogenic reefs are 3km from the FRR system outlet, at this distance the discharge will be fully dispersed to levels well below the EQS, and at a level that will not result in toxic contamination. An indication of the mixing zone is given in Figure 2. In addition, the calculation of the mixing zones does not take into consideration the consumption of the discharged matter by detritivores and scavengers, nor does it take account of the dynamic nature of the Severn Estuary.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the reef feature of the Severn Estuary SAC from the effects of toxic contamination.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The reefs feature is currently considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in nutrients.”

The largest mixing zone to assess nutrient enrichment against is 0.56km² the area affected by carbon enrichment, as given in Nutrient Enrichment methodology section above. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers or the seasonality of the discharge and are therefore conservative.

The intertidal biogenic reefs are located at least 3km from the FRR system outlet (as indicated by the red circle in Figure 9) and are the most vulnerable reef type. At this distance the discharge will be fully dispersed to levels well below those that will result in nutrient enrichment. An indication of the mixing zone is given in Figure 2.

The favourable condition table for the “reefs” feature (Table 9, Natural England and CCW, 2009) has a target for “No decline in community quality due to changes in species composition or loss of typical species from an established baseline subject to natural processes”.

An assessment of the dispersal of sprat following discharge from the FRR was conducted by the applicant (NNB GenCo, 2020b; TR479)[6]. This assessment predicted that the currents in the vicinity of HPC will distribute material discharged from the FRR along an approximately 12 km stretch of coastline as shown in Figure 4. As the nearest reefs are over 3km from the coastline, there is no potential for a change in community structure of this interest feature as a result of the FRR system outlet discharge.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the reef feature of the Severn Estuary SAC from the effects of nutrient enrichment.

Smothering and habitat loss

The Regulation 33 package (Natural England and CCW, 2009) does not identify the reefs interest feature as being sensitive of or exposed to smothering. WFD guidance (Environment Agency, 2016) categorises the sub-tidal reefs around the FRR system outlet as a lower sensitivity habitat. The most sensitive reef feature, intertidal biogenic reefs are located at least 3km from the FRR system outlet and are unlikely to experience smothering from the discharged matter.

The assessment is based upon the highest predicted discharge of matter occurring in December being applied across the year, whereas there will be fluctuations in the volume of the discharge. NNB GenCo (2020a; TR515) predicted that the lowest rate of discharge would occur in the spring months March to May and October, this is not accounted for in

[6] Sprat were assessed on the basis of them being the numerically-dominant contributors to discharged fish matter

the assessment. Table 6 in Environment Agency (2023d; AR001) predicts that there will be a daily total of 242kg of matter discharged from the FRR system (December), compared to a daily low of 44kg in October.

Figure 4 indicates that matter from the FRR system is predicted to be beached on the Atlantic salt meadow habitat, with particles around the biogenic reef habitat mostly consumed by birds and only available to smother the habitat when beached at low tide. However, based on the particle tracking model, this is likely to be only a small percentage of the outlet and is expected to be consumed rapidly by scavenging gulls once beached. Any impact will be short lived and is not expected to result in smothering of the habitat or habitat loss.

Conclusion

It is therefore possible to conclude **no adverse effect** on site integrity alone for the reef feature of the Severn Estuary SAC from the effects of smothering and habitat loss.

10.1.10. Conclusion – reefs appropriate assessment alone

It is therefore possible to conclude **no adverse effect** alone on the Annex II fish species of the Severn Estuary SAC.

An in-combination assessment is required.

10.1.11. Estuaries

As stated in the ecological narrative of the feature (Environment Agency, 2023b; Appendix 2), the Severn Estuary is the largest example of a coastal plain estuary in the UK, and one of the largest estuaries in Europe. It contributes approximately 30% of the UK Habitats sites resource for estuaries, by area.

The extent of the Estuary feature is 73,678ha.

The Severn Estuary SAC covers the extent of the tidal influence from an upstream limit between Frampton and Awre in Gloucestershire, and out seawards to a line drawn between Penarth Head in Wales and Hinkley point. It includes subtidal and intertidal areas landward to the line of high ground and flood defences (banks and walls) that provide the limit of tidal inundation.

Conservation objectives

The conservation objectives for the Estuaries feature of the Severn Estuary SAC is to maintain the feature in favourable condition, the full objectives can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

The feature will be in favourable condition when, subject to natural processes, each of the following relevant conditions are met:

- the extent, variety and spatial distribution of estuarine habitat communities within the site is maintained

- the extent, variety, spatial distribution and community composition of hard substrate habitats and their notable communities is maintained
- the abundance of the notable estuarine species assemblages is maintained or increased
- the physico-chemical characteristics of the water column support the ecological objectives described above
- toxic contaminants in water column and sediment are below levels which would pose a risk to the ecological objectives described above

Estuaries are therefore at risk from toxic contamination, nutrient enrichment, habitat loss and smothering, there is the potential that these risks could affect the communities supported by the feature.

“Estuaries” sub-features

The following sub-features of the “estuaries” feature of the SAC are also directly designated habitat features:

- “subtidal sandbanks”
- “intertidal mudflats and sandflats”
- “Atlantic salt meadows”
- “reefs”

The assessment carried out on these features of the SAC are therefore relevant for the SAC “estuaries” feature, refer to sections 10.1.3 to 10.1.9. A separate assessment will not be carried out.

An assessment will be carried out on the “hard substrate habitats (including eel grass beds)” as they do not have a separate designation.

As stated in the ecological narrative for this feature (Environment Agency, 2023b; Appendix 2), there is approximately 1,500ha of hard substrate habitat within the Severn Estuary, consisting of boulders, rock, mussel/cobble scars, rocky pools and shingle. The largest areas of hard substrate are located towards the outer estuary at Brean Down, Anchor Head and Sand Point together with rocky platforms and cliffs at Clevedon and Portishead. There are also extensive rock platforms at English stones, Aust and Beachley.

The “estuaries” feature of the SAC is also designated for its notable estuarine assemblages, including the “assemblage of vascular plant species”, “assemblage of waterfowl species” and “assemblage of fish species”.

The notable assemblage of vascular plant species includes eel grass (Zostera) species and salt marsh species. These have been assessed as part of the “Atlantic salt meadows” and “hard substrate (rocky shores, including eel grass beds)” features of the SAC. A separate assessment will not be carried out.

The “assemblage of waterfowl species” is supported by the “intertidal mudflats and sandflats”, “Atlantic salt meadows” and “hard substrate habitats”. The assemblage will be

assessed as part of the SPA (refer to section 10.2) and Ramsar (refer to section 10.3). A separate assessment will not be carried out.

The “assemblage of fish species” will be assessed as part of this appropriate assessment of the “estuaries” feature of the SAC.

Hard substrate (rocky shores, including eelgrass beds)

Hard substrate (rocky shores, including eel grass beds) is a notable sub-feature of the “estuaries” feature Severn Estuary SAC.

Beds of eelgrass (Zostera spp.) occur on some of the more sheltered mixed hard substrate areas around the Welsh side of the Second Severn Crossing. As there are no eel grass beds in the vicinity of the FRR system discharge point they are not relevant to this appropriate assessment and will not be considered further.

Assemblage of fish species

The “assemblage of fish species” is a notable species sub-feature of the “estuaries” feature of the SAC and includes the migratory, estuarine, marine, and freshwater species.

An ecological narrative for this sub-feature is provided in Appendix 2 to this HRA (Environment Agency, 2023b; Appendix 2).

Migratory species:

- allis shad
- Atlantic salmon
- European eel
- river lamprey
- sea lamprey
- sea trout
- twaite shad

Estuarine species:

- species typically occurring and breeding in estuaries (Bird, 2008)
- marine species occurring in large numbers in estuaries (Bird, 2008)

Marine species:

- predominantly marine species occurring infrequently in the Severn (Bird, 2008)

Freshwater species:

- species typically occurring and breeding in freshwater and recorded within the Severn SAC (Bird, 2008)

The conservation objective for the “estuaries” feature of the Severn Estuary SAC states that the estuaries feature (of which the assemblage is a notable sub-feature) will be in

favourable condition when, subject to natural processes, the following relevant conditions are met:

- the abundance of the notable estuarine species assemblages is maintained or increased
- toxic contaminants in water column and sediment are below levels which would pose a risk to the ecological objectives

The full objectives can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

The “assemblage of fish species” is reliant upon the protected habitats features of the Severn Estuary SAC, the indirect effects on the assemblage from impacts on the supporting habitats will therefore be considered.

The Regulation 33 package (Natural England and CCW, 2009) states that:

“The estuary habitats, tidal stretches of the feeding rivers and saltmarsh morphological features such as drainage channels, known locally as “pills” and “rhines” (“reens” in Wales) provide important feeding, breeding and sheltered nursery areas for a wide range of fish.”

It is likely that subtidal invertebrate communities play a role as a food resource for some species of the fish assemblage feature of the SAC and Ramsar Site.

The high biomass of invertebrates in the mudflats of the Severn provide an important food source for a diverse range and large number of fish and benthic predators. These intertidal areas are therefore important in supporting the fish assemblage sub-feature of the SAC “estuaries” feature.

Hard substrate habitats in the Severn Estuary provide a wide range of services for estuarine species. They are important components of the SAC Estuary feature, and also important supporting habitats for the fish assemblage of the SAC designation.

Toxic contamination

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The estuary feature is currently considered to have moderate sensitivity and high exposure and therefore high vulnerability to toxic contamination”.

In addition to the direct effects of toxic contamination, the Regulation 33 package also lists changes in oxygenation as a risk to the feature:

“The estuary feature is currently considered to have moderate sensitivity and high exposure and therefore high vulnerability to changes in oxygenation.

A cycle of changes in oxygenation occurs within the Severn as a result of both seasonal and tidal cycles and is linked to fluctuating sediment regimes. In addition, occasional,

intermittent oxygen sags occur in low salinity regions of the Severn and in some of the principal rivers feeding the Estuary.

Oxygen-deficient marine areas are characterized by a decline in the number and diversity of species. Certain communities occurring within the Estuary's intertidal mudflats and sandflats are moderately sensitive to decreases in dissolved oxygen levels. However, recoverability of these areas should be rapid upon return to normal conditions".

The Regulation 33 package does not provide specific guidance on impacts to the hard substrate feature in its 'advice on operations' section. However, there is advice on changes in oxygenation within the advice on supporting habitats for the SPA, which states that:

"Hard substrate habitats (rocky shores) of the estuary are considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation."

Table 23 of the Regulation 33 package (Natural England and CCW, 2009) indicates that the hard substrates habitat (as a supporting habitat of the SPA internationally important migratory species and waterfowl assemblage) is of moderate sensitivity and high exposure to the introduction of non-synthetic compounds.

The largest mixing zone to assess toxic contamination against is 9.78m² for unionised ammonia, and 0.064km² being needed to meet the oxygen demand through reaeration (refer to section 9.1.1). These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative worst-case and acute impact scenarios.

Figure 9 shows the location of rocky substrate in relation to the FRR system outlet. The nearest point of the hard substrate feature of the Severn Estuary SAC is approximately 170m to circalittoral rock and 300m to intertidal rock.

The mixing zone is predicted to be elliptical in shape, running parallel to the coast (Figure 2), whilst there is the potential for an overlap between circalittoral and intertidal rock and the discharge footprint with approximately 0.73 km² of the extensive rocky intertidal habitat expected to lie within the predicted settlement area for discharged material. These habitats are not thought to be highly sensitive to anthropogenic activities.

An assessment of the toxic effects of the FRR system outlet discharge has also been carried out on the habitats features of the "estuaries" feature of the Severn Estuary SAC: "subtidal sandbanks" (refer to section 10.1.3), "intertidal mudflats and sandflats" (refer to section 10.1.5), "Atlantic salt meadows" (refer to section 10.1.7) and "reefs" (refer to section 10.1.9). The appropriate assessments concluded that there will be no adverse effect on these features from the direct effect of toxic contamination.

Hard substrate (rocky shores, including eelgrass beds)

The Regulation 33 package (Natural England and CCW, 2009) does not provide specific guidance on impacts to the hard substrate feature in its 'advice on operations' section. However, there is advice on changes in oxygenation within the advice on supporting habitats for the SPA, which states that:

Hard substrate habitats (rocky shores) of the estuary are considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation.

Table 23 of the Regulation 33 package indicates that the hard substrates habitat (as a supporting habitat of the SPA Internationally important migratory species and waterfowl assemblage) is of moderate sensitivity and high exposure to the Introduction of non-synthetic compounds.

The largest mixing zone to assess toxic contamination against is 9.78m^2 for unionised ammonia, and 0.064km^2 being needed to meet the oxygen demand through reaeration (refer to section 9.1.1). These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative worst-case and acute impact scenarios.

Figure 9 shows the location of rocky substrate in relation to the FRR system discharge point. The nearest point of the hard substrate feature of the Severn Estuary SAC and Ramsar is approximately 170m to circalittoral rock and 300m to intertidal rock.

The mixing zone is predicted to be elliptical in shape, running parallel to the coast (Figure 2), whilst there is the potential for an overlap between circalittoral and intertidal rock and the discharge footprint with, approximately 0.73 km^2 of the extensive rocky intertidal habitat expected to lie within the predicted settlement area for discharged material, these habitats are not thought to be highly sensitive to anthropogenic activities.

Assemblage of fish species

The predicted mixing zones used to assess the toxic effects of the FRR system outlet do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

It is considered that the largest mixing zone of 9.78m² is inconsequential when compared against the Severn Estuary SAC, which covers an area of 737km².

Toxic contaminants in the water column are expected to meet their EQS within a small mixing zone and is unlikely to impact upon the use of the Severn Estuary by the "assemblage of fish species".

Conclusion: toxic contamination

There will be **no adverse effect** on the “estuaries” feature of the SAC, including its notable “assemblage of fish species” from the effects of toxic contamination.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The estuary feature is considered to have high sensitivity and high exposure to changes in nutrient loading but is not considered vulnerable to changes in nutrient loading due to the high natural turbidity.

Whilst nutrient levels and loadings within the Estuary are considered significant in UK terms (and thus have been scored as high for sensitivity and high for exposure), the high natural turbidity of the system negates these high levels, with algal productivity being generally low except in localised hotspots. Where these do occur, nutrient enrichment may lead to significant shifts in community composition on/in subtidal sandbanks and on/in intertidal mudflats and sandflats, but recoverability is likely to be high. Should there be a decrease in natural turbidity levels, then the overall associated ‘masking effect’ would be lessened and there would be a higher risk of nutrient enrichment.

At the present time, despite the high sensitivity and high exposure scores discussed above, the high natural turbidity levels across most of the estuary lead to a conclusion that the estuary is not considered vulnerable to changes in nutrient loading.”

The Regulation 33 package does not provide specific guidance on impacts to the hard substrate feature in its ‘advice on operations’ section. However, Table 23 of the Regulation 33 package (Natural England and CCW, 2009) indicates that the hard substrates habitat (as a supporting habitat of the SPA internationally important migratory species and waterfowl assemblage) is of low sensitivity and high exposure to changes in nutrient loading.

The largest mixing zone to assess nutrient enrichment against is 0.56km² the area affected by carbon enrichment, as given in section 9.1.2. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative worst-case and acute impact scenarios.

Figure 9 shows the location of rocky substrate in relation to the FRR system outlet. The nearest point of the hard substrate feature of the Severn Estuary SAC and Severn Estuary Ramsar is approximately 170m to circalittoral rock and 300m to intertidal rock.

The mixing zone is predicted to be elliptical in shape, running parallel to the coast (Figure 2), whilst there is the potential for an overlap between circalittoral and intertidal rock and the discharge footprint with, approximately 0.73 km² of the extensive rocky intertidal

habitat expected to lie within the predicted settlement area for discharged material, these habitats are not thought to be highly sensitive to anthropogenic activities.

An assessment of the potential of the FRR system outlet discharge to result in nutrient enrichment has been carried out on the “estuaries” feature of the Severn Estuary SAC: “subtidal sandbanks” (refer to section 10.1.3), “intertidal mudflats and sandflats” (refer to section 10.1.5), “Atlantic salt meadows” (refer to section 10.1.7) and “reefs” (refer to section 10.1.9).

Hard substrate (rocky shores, including eelgrass beds)

The Regulation 33 package (Natural England and CCW, 2009) does not provide specific guidance on impacts to the hard substrate feature in its ‘advice on operations’ section. However, Table 23 of the Regulation 33 package indicates that the hard substrates habitat (as a supporting habitat of the SPA internationally important migratory species and waterfowl assemblage) is of low sensitivity and high exposure to changes in nutrient loading.

The largest mixing zone to assess nutrient enrichment against is 0.56km² the area affected by carbon enrichment, as given in section 9.1.2. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative worst-case and acute impact scenarios.

Figure 9 shows the location of rocky substrate in relation to the FRR system outlet. The nearest point of the hard substrate feature of the Severn Estuary SAC and Severn Estuary Ramsar is approximately 170m to circalittoral rock and 300m to intertidal rock.

The mixing zone is predicted to be elliptical in shape, running parallel to the coast (Figure 2), whilst there is the potential for an overlap between circalittoral and intertidal rock and the discharge footprint with, approximately 0.73 km² of the extensive rocky intertidal habitat expected to lie within the predicted settlement area for discharged material, these habitats are not thought to be highly sensitive to anthropogenic activities.

Assemblage of fish species

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“It is possible that changes in nutrient levels may affect the food supply of the shad and lamprey. However, due to the natural high turbidity of the system and the volumes of water involved, it is thought that any effects would be minimal.”

This assumption can also be made for the fishes within the “assemblage of fish species” notable sub-feature.

The largest mixing zone to assess nutrient enrichment against is 0.56km² for organic enrichment, as given in section 9.1.2. These predicted mixing zones do not consider tidal

dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

It is considered that this mixing zone is inconsequential when compared against the Severn Estuary SAC site, which covers an area of 737km².

The small area of area affected by organic enrichment is unlikely to impact upon the food supply of the “assemblage of fish species”.

Conclusion: nutrient enrichment

There will be **no adverse effect** on the “estuaries” feature of the SAC, including its notable “assemblage of fish species”, from the effects of nutrient enrichment.

Smothering and habitat loss

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The estuary feature is considered to have high sensitivity and moderate exposure and therefore high vulnerability to smothering.

Smothering of organisms is likely to occur as a result of the direct deposition of material on top of them and/or on their habitat.

Both intertidal and subtidal seagrass beds are considered to be highly sensitive to smothering.”

Figure 5 shows that there are no intertidal sea grass beds close to the FRR system outlet and are therefore not at risk from this discharge.

The Regulation 33 package does not provide specific guidance on impacts to the hard substrate feature in its ‘advice on operations’ section. However, Table 23 of the Regulation 33 package indicates that the hard substrates habitat (as a supporting habitat of the SPA “internationally important populations of migratory species” and the “internationally assemblage of waterfowl”) is of moderate sensitivity and moderate exposure to smothering.

The assessment is based upon the highest predicted discharge of matter occurring in December being applied across the year, whereas there will be fluctuations in the volume of the discharge. NNB GenCo (2020a; TR515) predicted that the lowest rate of discharge would occur in the spring months March to May and October, this is not accounted for in the assessment. Table 6 in Environment Agency (2023d; AR001) predicts that there will be a daily total of 242kg of matter discharged from the FRR system (December), compared to a daily low of 44kg in October.

Figure 4 indicates that matter from the FRR system is predicted to be beached on the intertidal and circalittoral rock habitat. However, based on the particle tracking model, this is likely to be only a small percentage of the outlet and is expected to be consumed rapidly

by scavenging gulls once beached. Any impact will be short lived and is not expected to result in smothering of the habitat or habitat loss.

An assessment of the potential of the FRR system outlet discharge to result in smothering and habitat loss has also been carried out on the following features of the Severn Estuary SAC: “subtidal sandbanks” (refer to section 10.1.3), “intertidal mudflats and sandflats” (refer to section 10.1.5), “Atlantic salt meadows” (refer to section 10.1.7) and “reefs” (refer to section 10.1.9). It was possible to conclude no adverse effect from smothering and habitat loss.

Hard substrate (rocky shores, including eelgrass beds)

The Regulation 33 package (Natural England and CCW, 2009) does not provide specific guidance on impacts to the hard substrate feature in its ‘advice on operations’ section. However, Table 23 of the Regulation 33 package indicates that the hard substrates habitat (as a supporting habitat of the SPA internationally important migratory species and waterfowl assemblage) is of moderate sensitivity and moderate exposure to smothering.

The assessment is based upon the highest predicted discharge of matter occurring in December being applied across the year, whereas there will be fluctuations in the volume of the discharge. NNB GenCo (2020a; TR515) predicted that the lowest rate of discharge would occur in the spring months March to May and October, this is not accounted for in the assessment. Table 6 in Environment Agency (2023d; AR001) predicts that there will be a daily total of 242kg of matter discharged from the FRR system (December), compared to a daily low of 44kg in October.

Figure 4 indicates that matter from the FRR system is predicted to be beached on the intertidal and circalittoral rock habitat. However, based on the particle tracking model, this is likely to be only a small percentage of the outlet and is expected to be consumed rapidly by scavenging gulls once beached. Any impact will be short lived and is not expected to result in smothering of the habitat or habitat loss.

Assemblage of fish species

Table 22 of the Regulation 33 (Natural England and CCW, 2009) package indicates that the Annex II species of the SAC have a low vulnerability to direct effects of smothering, with no detectable sensitivity and low exposure.

This assumption can also be made for the fishes within the “assemblage of fish species” notable sub-feature.

The indirect effects on the saltmarsh habitats will therefore be considered as part of this assessment.

The supporting habitats of the “assemblage of fish species” within the Severn Estuary (the “intertidal mudflats and sandflats” (refer to section 10.1.5), “Atlantic salt meadows” (refer to section 10.1.7) and “hard substrate” (refer to section 10.1.11)) have been assessed for the effects of smothering and habitat loss and a conclusion of no adverse effect was reached.

Conclusion: smothering and habitat loss

There will be **no adverse effect** on the “estuaries” feature of the SAC, including its notable “assemblage of fish species”, from the effects of smothering and habitat loss.

10.1.12. Conclusion – “estuaries” feature appropriate assessment alone

It is possible to conclude **no adverse effect** alone on the “estuaries” feature of the Severn Estuary SAC, including its notable sub-features.

An in-combination assessment is required.

10.2. Severn Estuary SPA

The following is the appropriate assessment alone for the features of the Severn Estuary SPA. The assessment will be made against the relevant conservation objectives and information available in the Severn Estuary EMS Regulation 33 package (Natural England and CCW, 2009).

10.2.1. Annex I species

The Bewick’s swan is an Annex I listed feature of the Severn Estuary SPA. The key supporting habitats for this feature are the “intertidal mudflats and sandflats” and “Atlantic salt meadows” feature of the SAC.

An ecological narrative for this species is provided in Appendix 2 of this HRA (Environment Agency, 2023b; Appendix 2).

Conservation objectives

The conservation objective is to maintain the Bewick’s swan population and its supporting habitats in favourable condition, as defined below.

The interest feature Bewick’s swan will be considered to be in favourable condition when, subject to natural processes, following condition relevant to this assessment is met:

(ii) the extent of saltmarsh at the Dumbles is maintained

(iii) the extent of intertidal mudflats and sandflats at Frampton Sands, Waveridge Sands and the Noose is maintained

(iv) greater than 25% cover of suitable soft-leaved herbs and grasses in winter season throughout the transitional saltmarsh at the Dumbles is maintained

An ecological narrative of the Annex I species, Bewick’s swan, and the internationally important populations of waterfowl are provided in Appendix 2 of this HRA (Environment Agency, 2023b; Appendix 2).

The Regulation 33 (Natural England and CCW, 2009) package provides information on the vulnerability of the Bewick’s swan as a feature of the Severn Estuary SPA, based on the vulnerability of its supporting habitat to damage from anthropogenic activities.

Supporting habitat

The primary habitats of the Bewick's swan are "intertidal mudflats and sandflats" and "Atlantic salt meadows" (Natural England and CCW, 2009)

The focal area for the Bewick's swan is the upper Severn Estuary in the vicinity of the New Grounds, Slimbridge area (refer to Birds – ASERA) as reflected in the conservation objectives.

This assessment will therefore refer to sections 10.1.5 Intertidal mudflats and sandflats and 10.1.7 Atlantic salt meadows.

10.2.2. Internationally important population of regularly occurring migratory species

The internationally important population of regularly occurring migratory species includes populations of European white-fronted goose, dunlin, redshank, shelduck and gadwall.

Conservation objectives

The conservation objective is to maintain the redshank population and its supporting habitats in favourable condition.

The interest feature redshank will be considered to be in favourable condition when, subject to natural processes each of the following relevant conditions are met:

Wintering European white fronted goose:

- the extent of saltmarsh at the Dumbles is maintained
- the extent of intertidal mudflats and sandflats at Frampton Sands, Waveridge Sands and the Noose is maintained
- greater than 25% cover of suitable soft-leaved herbs and grasses is maintained during the winter on saltmarsh areas

Wintering dunlin:

- the extent of saltmarsh and associated strandlines is maintained
- the extent of intertidal mudflats and sandflats is maintained
- the extent of hard substrate habitats is maintained
- the extent of vegetation with a sward height of <10cm throughout the saltmarsh is maintained
- the abundance and macro-distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained

Wintering redshank:

- the extent of saltmarsh and associated strandlines is maintained
- the extent of intertidal mudflats and sandflats is maintained
- the extent of hard substrate habitats is maintained

- the extent of vegetation with a sward height of <10cm throughout the saltmarsh is maintained
- the abundance and macro-distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained
- the abundance and macro-distribution of suitable invertebrates in hard substrate habitats is maintained

Wintering shelduck:

- the extent of saltmarsh and associated strandlines is maintained
- the extent of intertidal mudflats and sandflats is maintained
- the extent of hard substrate habitats is maintained
- the extent of vegetation with a sward height of <10cm throughout the saltmarsh is maintained
- the abundance and macro-distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained
- the abundance and macro-distribution of suitable invertebrates in hard substrate habitats is maintained

Supporting habitat

The relevant supporting habitats of the internationally important population of regularly occurring migratory species of the SPA are as follows:

- European white-fronted goose: “intertidal sandflats and mudflats” and “Atlantic salt meadows”
- dunlin: “intertidal sandflats and mudflats”, “Atlantic salt meadows” and “hard substrate (rocky shores)”
- redshank: “intertidal sandflats and mudflats”, “Atlantic salt meadows” and “hard substrate (rocky shores)”
- shelduck: “intertidal sandflats and mudflats”, “Atlantic salt meadows” and “hard substrate (rocky shores)”

Gadwall utilise freshwater wetlands and are not primarily found within the Severn Estuary SPA supporting habitats boundary. Dunlin and shelduck occur in large numbers in Bridgwater Bay, feeding in the intertidal and mid-shore areas of the estuary. The European white fronted goose over winter on the Severn feeding on the saltmarsh, permanent pastures and other farmland. They are concentrated around Slimbridge (refer to Birds – ASERA).

10.2.3. Internationally important assemblage of waterfowl

Curlew, grey plover, pintail, pochard, ringed plover, spotted redshank, teal, tufted duck, whimbrel and wigeon.

Conservation objectives

For the internationally important assemblage of waterfowl, the conservation objective is to maintain the waterfowl assemblage and its supporting habitats in favourable condition.

The interest feature waterfowl assemblage will be in favourable condition when, subject to natural processes, each of the following relevant conditions are met:

- the extent of saltmarsh and their associated strandlines is maintained
- the extent of intertidal mudflats and sandflats is maintained
- the extent of hard substrate habitats is maintained
- extent of vegetation of <10cm throughout the saltmarsh is maintained
- the abundance and macroscale distribution of suitable invertebrates in intertidal mudflats and sandflats is maintained
- the abundance and macroscale distribution of suitable invertebrates in hard substrate habitats is maintained
- greater than 25% cover of suitable soft leaved herbs and grasses during the winter on saltmarsh areas is maintained

Supporting habitat

The relevant supporting habitats of the “internationally important assemblage of waterfowl” of the SPA are “intertidal mudflats and sandflats”, “Atlantic saltmarsh” and “hard substrate habitats (rocky shores)”.

The Regulation 33 package (Natural England and CCW, 2009) provides information on the vulnerability of internationally important waterfowl assemblage, based on the vulnerability of its supporting habitat to damage from anthropogenic activities. This information will be considered in our assessment.

Of particular note to the area of Hinkley Point C are the populations of Whimbrel and spotted redshank, which have populations on Steart Island, curlew can be found in large numbers on the mudflats of Bridgwater Bay. Wigeon and pintail are widely distributed across the Severn Estuary. Other notable species are largely found at New Grounds near Lydney and at Peterstone and Rhymney on the Welsh coast (Natural England and CCW, 2009).

Toxic contamination

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“Waterfowl are subject to the accumulation of toxins through the food chain or through direct contact with toxic substances when roosting or feeding. Their ability to feed can also be affected by the abundance or change in palatability of their prey caused by toxic contamination. At the moment there is no evidence to show that this is the case, but the estuary is vulnerable to oil spills and there is a continuous discharge of toxins into the estuary some of which bind to the sediments.

Bewick’s swans have a moderate vulnerability to toxic contamination.”

“Waterfowl are subject to the accumulation of toxins through the food chain or through direct contact with toxic substances when roosting or feeding. Their ability to feed can also

be affected by the abundance or change in palatability of their prey caused by toxic contamination. At the moment there is no evidence to show that this is the case on the Severn Estuary, but the estuary is vulnerable to oil spills and there is a continuous discharge of toxins into the estuary, some of which bind to the sediments.

The intertidal mudflats and sandflats and the saltmarsh are currently highly vulnerable to the introduction of synthetic and non-synthetic compounds."

The FRR system outlet will not directly discharge any synthetic or non-synthetic toxic compounds, as a result there will be no potential for the bioaccumulation of toxins.

In addition to the direct effects of toxic contamination, the Regulation 33 package also lists changes in oxygenation as a risk to the feature:

"It is thought unlikely that changes in oxygenation within the Estuary will affect the Bewick's swan feature directly, but such changes may influence the community composition of supporting saltmarsh habitats on which this species are dependant for feeding. The saltmarshes of the estuary are considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation. Impacts on these habitats may affect the long-term survival of individuals (in terms of energy and competition) or alter behaviour and patterns of use or distribution".

Similar advice is provided for the "internationally important assemblage of waterfowl":

"It is thought unlikely that changes in oxygenation within the Estuary will affect the waterfowl assemblage feature directly, but such changes may have marked effects on the community composition of supporting habitats on which these species are dependant for feeding. The saltmarshes, intertidal mudflats and sand flats and hard substrate habitats (rocky shores) of the estuary are considered to have low sensitivity and high exposure and therefore moderate vulnerability to changes in oxygenation. Impacts on these habitats may affect the long-term survival of individuals (in terms of energy and competition) or alter behaviour and patterns of use or distribution."

The largest mixing zone needed to meet the oxygen demand through reaeration is 0.064km², as given in Toxic Contamination methodology section above. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

The nearest point of the "Atlantic salt meadows" supporting habitat of the Severn Estuary SPA is at least 3km from the FRR system outlet (as indicated by the red circle in Figure 8). At this distance the discharge will be fully aerated, and at a level that will not result in impacts from changes in aeration. An indication of the mixing zone is given in Figure 2.

The nearest point of the "intertidal mudflats and sandflats" supporting habitat of the Severn Estuary SPA is approximately 200m from the FRR system outlet (as indicated by the red circle in Figure 7). The mixing zone is predicted to be a narrow elliptical shape, running parallel to the coast (Figure 2), with little potential for an overlap between the intertidal

mudflats and sandflats and the mixing zone. In addition, the calculation of the mixing zones does not take into consideration the consumption of the discharged matter by detritivores and scavengers, which is expected to be rapid, nor does it take account of the dynamic nature of the Severn Estuary.

Conclusion: toxic contamination

It is possible to conclude that there will be **no adverse effect** alone on the Severn Estuary SPA from toxic contamination.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“Changes in organic or nutrient loading can change the species composition of the plants on the saltmarsh and thus the structure of the sward. This could affect the palatability of the sward for grazing Bewick’s swans and therefore affect the availability of adequate preferred feeding areas within the SPA. There are critical areas for this species located at the Dumbles in the uppermost part of the estuary all of which are grazed.”

“The intertidal habitats and therefore the waterfowl assemblage feature which these habitats support are considered to have moderate to high sensitivity and moderate to high exposure and therefore moderate to high vulnerability to physical loss (substratum loss and smothering).

Activities or developments resulting in physical loss of the intertidal supporting habitats are likely to reduce the availability of food and roosting habitat and thus be detrimental to the favourable condition of the SPA interest features including all the migratory species and waterfowl assemblage.

Eelgrass beds (which are a food source for some species of the assemblage) are being affected by siltation due to changes in sediment movement after construction of the Second Severn Crossing which has resulted in smothering.”

As stated in the Regulation 33 package, the Severn Estuary is highly turbid, with algal productivity generally being low. The area of Bridgwater Bay that the FRR discharges into is not considered to be a hotspot for algal growth, the WFD assessment identified the phytoplankton status of the bay as being ‘moderate’ (refer to section 10.1.3), but also concluded that discharge of dead matter from the FRR system will not result in deterioration of WFD status at the water body scale because of impacts on water quality (Environment Agency, 2023e; Water Framework Directive assessment for the Hinkley Point C).

The largest mixing zone to assess nutrient enrichment against is 0.56km² the area affected by carbon enrichment, as given in section 9.1.2. This predicted mixing zone does not consider tidal dispersion of the discharged matter, consumption of the matter by

detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

The assessment of nutrient enrichment on the “Atlantic salt meadows” feature of the SAC (refer to section 10.1.7) concluded that the nearest point of the feature is at least 3km from the FRR system outlet. The nearest point of the “intertidal mudflats and sandflats” feature is approximately 200m from the FRR system outlet (as indicated by the red circle in Figure 7), the nearest point of the “hard substrate” feature of the Severn Estuary SAC is approximately 170m to circalittoral rock and 300m to intertidal rock (**Figure 9**).

The shape and position of the mixing zone is unlikely to overlap with the “intertidal mudflats and sandflats” and “Atlantic salt meadows” supporting features of the of the Severn Estuary SPA.

Whilst there is the potential for an overlap between circalittoral and intertidal rock and the discharge footprint with, approximately 0.73 km² of the extensive rocky intertidal habitat expected to lie within the predicted settlement area for discharged material, these habitats are not thought to be highly sensitive to anthropogenic activities.

Conclusion: nutrient enrichment

It is possible to conclude that there will be **no adverse effect** alone on the Severn Estuary SPA from nutrient enrichment.

Smothering and habitat loss

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that for the “Annex I species” feature:

“The intertidal habitats and therefore the Bewick’s Swan feature which these habitats support are considered to have moderate to high sensitivity and moderate to high exposure and therefore moderate to high vulnerability to physical loss (removal and smothering).

The physical loss of areas of intertidal habitats may be caused directly through change of land use or indirectly as a consequence of changes to sedimentation processes.

Activities or developments resulting in physical loss of the intertidal supporting habitats are likely to reduce the availability of food and roosting habitat and thus be detrimental to the favourable condition of the SPA interest features including the Annex I species, Bewick’s swan.”

The appropriate assessment of the impacts of smothering on the Intertidal mudflats and sandflats and Atlantic salt meadows was able to conclude no adverse effect on site integrity.

It is expected that the small percentage of discharged matter that has the potential to be beached on the intertidal habitats and saltmarsh will be rapidly consumed by scavenging gulls.

There will be no direct physical loss of the intertidal sandflats and mudflats or saltmarsh habitats because of the discharge of matter from the FRR system, and it is not expected that the availability of food and roosting habitat will be impacted by the discharge. The key supporting habitats for the Bewick's swan are in the upper reaches of the estuary which are important for feeding and roosting.

The Regulation 33 package states that for the "internationally important waterfowl assemblage":

"The intertidal habitats and therefore the waterfowl assemblage feature which these habitats support are considered to have moderate to high sensitivity and moderate to high exposure and therefore moderate to high vulnerability to physical loss (substratum loss and smothering).

Activities or developments resulting in physical loss of the intertidal supporting habitats are likely to reduce the availability of food and roosting habitat and thus be detrimental to the favourable condition of the SPA interest features including all the migratory species and waterfowl assemblage.

Eelgrass beds (which are a food source for some species of the assemblage) are being affected by siltation due to changes in sediment movement after construction of the Second Severn Crossing which has resulted in smothering."

Beds of eelgrass (Zostera spp.), occur on some of the more sheltered mixed hard substrate areas around the Welsh side of the Second Severn Crossing. As there are no eelgrass beds in the vicinity of the FRR system discharge point they are not relevant to this appropriate assessment and will not be considered further in this assessment.

There are no mechanisms of impact that will result in the direct loss of intertidal supporting habitats of the "internationally important populations of regularly occurring migratory species". There is the potential for indirect effects on roosting areas and food availability through the beaching of matter from the FRR system. This has been assessed as part of the Annex I species assessment in section 10.2.1 of this HRA.

It is expected that the small percentage of discharged matter that has the potential to be beached on the intertidal habitats and saltmarsh will be rapidly consumed by scavenging gulls.

Conclusion: smothering and habitat loss

As a result, it is also possible to conclude that there will be **no adverse effect** alone on the Severn Estuary SPA.

10.2.4. Conclusion – Severn Estuary SPA appropriate assessment alone

It is therefore possible to conclude **no adverse effect** alone on the hard substrate (rocky shore, including eelgrass beds) habitat of the Severn Estuary SPA.

An in-combination assessment is required.

10.3. Severn Estuary Ramsar

The following is the appropriate assessment alone for the features of the Severn Estuary Ramsar. The assessment will be made against the relevant conservation objectives and information available in the Severn Estuary Regulation 33 package (Natural England and CCW, 2009).

The interest features of the Severn Estuary Ramsar site overlap with those of the Severn Estuary SAC and Severn Estuary SPA. Results of the appropriate assessment for the SAC and SPA will be used to inform this Ramsar assessment.

The Regulation 33 advice package notes that “the Ramsar Site within the European Marine Site boundary includes saltmarshes and the adjacent extensive areas of intertidal mud, sand and rocky shores. All these habitats provide essential food and resting places for the wide range of wintering and migratory waterfowl and are therefore identified as key “supporting habitats” for the conservation of these species”.

10.3.1. Estuaries

The “estuaries” interest feature of the Severn Estuary Ramsar is designated under Ramsar Criterion 1, qualifying due to its immense tidal range (second largest in world) affecting both the physical environment and biological communities, and Ramsar Criterion 3, qualifying due to its unusual estuarine communities, reduced diversity and high productivity.

The “estuaries” habitats support the Ramsar’s “notable estuarine species assemblages”, including assemblages of fish species, waterfowl species and vascular plant species.

The assessment carried out on “estuaries” feature of the SAC is therefore relevant for the Ramsar site “estuaries” feature, including its “notable estuarine species assemblages”. A separate assessment will not be carried out.

Conservation objectives

The conservation objective for the “estuaries” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SAC “estuaries” feature” (refer to section 10.1.11 of this document), in so far as these objectives are applicable to the area designated as Ramsar Site.

The Severn Estuary EMS Regulation 33 advice package (Natural England and CCW, 2009) states that “the area of the estuarine ecosystem designated as Ramsar Site is smaller than that of the SAC as it is restricted to the terrestrial and intertidal areas and excludes all subtidal areas.

There are therefore aspects of the SAC “estuaries” conservation objective that are not applicable to the Ramsar Site “estuaries” feature.”

The limits of the relevant “estuaries” objective conditions to be met, if any, are described below.

“The extent, variety and spatial distribution of estuarine habitat communities within the site is maintained”. Within the Ramsar site this is limited to the habitats listed as Ramsar “estuarine habitats communities” including intertidal mudflats and sandflats and saltmarshes (equivalent to the Atlantic saltmeadows feature of the SAC)

“The extent, variety, spatial distribution and community composition of hard substrate habitats and their notable communities is maintained”. Within the Ramsar site this is limited to the habitats listed as Ramsar “hard substrate communities” including all hard substrate (rocky shore) communities within the Ramsar Site boundary.

“The abundance of the notable estuarine species assemblages is maintained or increased”. Within the Ramsar Site this is limited to the species listed as Ramsar “notable estuarine species assemblages” including the assemblage of fish species, assemblage of waterfowl species and the assemblage of vascular plant species.

“The physico-chemical characteristics of the water column support the ecological objectives”. These requirements apply estuary wide at a whole ecosystem level.

“Toxic contaminants in water column and sediment are below levels which would pose a risk to the ecological objectives”. These requirements apply estuary wide at a whole ecosystem level.

Toxic contamination

An assessment of the toxic effects of the FRR system outlet discharge has been carried out on the “estuaries” (refer to section 10.1.11) feature of the Severn Estuary SAC.

This assessment concluded that there will be no adverse effect on the “estuaries” feature from the direct effect of toxic contamination.

Conclusion: toxic contamination

It is possible to conclude **no adverse effect** alone on the “estuaries” feature of the Severn Estuary Ramsar site from the effects of toxic contamination.

Nutrient enrichment

An assessment of the potential of the FRR system outlet discharge to result in nutrient enrichment has been carried out on the “estuaries” (refer to section 10.1.11) feature of the Severn Estuary SAC.

This assessment concluded that there will be no adverse effect on the “estuaries” feature from the direct effect of nutrient enrichment.

Conclusion: nutrient enrichment

It is possible to conclude **no adverse effect** alone on the “estuaries” feature of the Severn Estuary Ramsar site from the effects of nutrient enrichment.

Smothering and habitat loss

An assessment of the potential of the FRR system outlet discharge to result in smothering and habitat loss has been carried out on the “estuaries” (refer to section 10.1.11) feature of the Severn Estuary SAC.

This assessment concluded that there will be no adverse effect on the “estuaries” feature from the direct effect of smothering and habitat loss.

Conclusion: smothering and habitat loss

It is possible to conclude **no adverse effect** alone on the “estuaries” feature of the Severn Estuary Ramsar site from the effects of smothering and habitat loss.

10.3.2. Assemblage of migratory fish species

The “assemblage of migratory fish species” includes the Atlantic salmon, allis shad, twaite shad, river lamprey, sea lamprey, sea trout and European eel.

These species are also included within the “assemblage of fish species” notable feature of the “estuaries” Severn Estuary SAC feature, with the river lamprey, sea lamprey and twaite shad being designated as “Annex II” features of the SAC.

The assessment carried out on these features of the SAC are therefore relevant for the Ramsar site (refer to sections 10.1.1 and 10.1.11). A separate assessment will not be carried out.

Conservation objectives

The conservation objective for the “assemblage of migratory fish species” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, the full objectives can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

The feature will be in favourable condition when, subject to natural processes, each of the following relevant conditions are met:

- the migratory passage of both adults and juveniles of the assemblage of migratory fish species through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows, or poor water quality
- toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above

The Regulation 33 advice package (Natural England and CCW, 2009) notes that “the populations of three of the assemblage species (river lamprey, sea lamprey and twaite shad) are designated as features of the SAC for which separate specific objectives have been written”.

Toxic contamination

The “assemblage of migratory fish species” feature is sensitive to toxic contamination, the favourable condition table of the Regulation 33 package (Natural England and CCW, 2009) states that for the conservation objective related to barriers for migration:

“Dissolved oxygen can also be significantly reduced in stretches receiving significant BOD inputs, or through the re-suspension of organic rich sediments.

Toxic contaminants may act as a barrier to migration.”

An assessment of the toxic effects of the FRR system outlet discharge has been carried out on the “Annex II” species (refer to section 10.1.1) and “assemblage of fish species” notable feature (refer to section 10.1.11) of the Severn Estuary SAC.

Both assessments concluded that there will be no adverse effect from the direct effect of toxic contamination.

Conclusion: toxic contamination

It is possible to conclude that there will be **no adverse effect** alone on the “assemblage of migratory fish species” of the Severn Estuary Ramsar from the effects of toxic contamination.

Nutrient enrichment

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that, for the migratory species of the Ramsar that are Annex II species of the Severn Estuary SAC:

“It is possible that changes in nutrient levels may affect the food supply of the shad and lamprey. However, due to the natural high turbidity of the system and the volumes of water involved, it is thought that any effects would be minimal.”

An assessment of the potential of the FRR system outlet discharge to result in nutrient enrichment of the “Annex II” species (twaite shad) (refer to section 10.1.1) and “assemblage of fish species” notable feature (refer to section 10.1.11) of the Severn Estuary SAC.

Both assessments concluded that there will be no adverse effect from the effect of nutrient enrichment.

Conclusion: nutrient enrichment

It is possible to conclude that there will be **no adverse effect** alone on the “assemblage of migratory fish species” of the Severn Estuary Ramsar from the effects of nutrient enrichment.

Smothering and habitat loss

The Regulation 33 package (Natural England and CCW, 2009) for the Severn Estuary EMS states that:

“The estuary habitats, tidal stretches of the feeding rivers and saltmarsh morphological features such as drainage channels, known locally as “pills” and “rhines” (“reens” in Wales) provide important feeding, breeding and sheltered nursery areas for a wide range of fish.”

An assessment of the potential of the FRR system outlet discharge to result in smothering and habitat loss of the “Annex II” species (twaite shad) (refer to section 10.1.1) and “assemblage of fish species” notable feature (refer to section 10.1.11) of the Severn Estuary SAC.

Both assessments concluded that there will be no adverse effect from the effect of smothering and habitat loss.

Conclusion: smothering and habitat loss

It is possible to conclude that there will be **no adverse effect** alone on the “assemblage of migratory fish species” of the Severn Estuary Ramsar from the effects of smothering and habitat loss.

10.3.3. Internationally important populations of waterfowl

The Ramsar supports over-wintering important populations of species of waterfowl, including Bewick’s swan, European white-fronted goose, dunlin, redshank, shelduck and gadwall.

These waterfowl are also designated as part of the Severn Estuary SPA “Annex I species” (Bewick’s swan) and the “internationally important populations of regularly occurring migratory species” (European white-fronted goose, dunlin, redshank, shelduck and gadwall). The assessment carried out on these features of the SPA is therefore relevant for the Ramsar site (refer to section 10.2.1 and 10.2.210.2.2). A separate assessment will not be carried out.

Conservation objectives

The conservation objectives for the “internationally important populations of waterfowl” feature of the Severn Estuary Ramsar is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA (refer to section 10.2.2).

Toxic contamination

An assessment of the toxic effects of the FRR system outlet discharge has been carried out on the “Annex I” (Bewick’s swan) (refer to section 10.2.1) and “internationally important populations of regularly occurring migratory species” (refer to section 10.2.2) of the Severn Estuary SPA.

Both assessments concluded that there will be no adverse effect on site integrity from the direct effect of toxic contamination.

Conclusion: toxic contamination

It is possible to conclude **no adverse effect** alone on the “internationally important populations of waterfowl” feature of the Severn Estuary Ramsar site from the effects of toxic contamination.

Nutrient enrichment

An assessment of the potential of the FRR system outlet discharge to result in nutrient enrichment has been carried out on the “Annex I” (Bewick’s swan) (refer to section 10.2.1) and “internationally important populations of regularly occurring migratory species” (refer to section 10.2.2) of the Severn Estuary SPA,.

Both assessments concluded that there will be no adverse effect on site integrity from the effects of nutrient enrichment.

Conclusion: nutrient enrichment

It is possible to conclude **no adverse effect** alone on the “internationally important populations of waterfowl” feature of the Severn Estuary Ramsar site from the effects of nutrient enrichment.

Smothering and habitat loss

An assessment of the potential of the FRR system outlet discharge to result in smothering and habitat loss of the supporting habitat of the “internationally important populations of waterfowl” been carried out on the “Annex I” (Bewick’s swan) (refer to section 10.2.1) and “internationally important populations of regularly occurring migratory species” (refer to section 10.2.2) features of the Severn Estuary SPA,.

Both assessments concluded that there will be no adverse effect on site integrity from the effects of smothering and habitat loss.

Conclusion: smothering and habitat loss

It is possible to conclude **no adverse effect** alone on the “internationally important populations of waterfowl” feature of the Severn Estuary Ramsar site from the effects of smothering and habitat loss.

10.3.4. Internationally important assemblage of waterfowl

This feature incorporates internationally important wintering populations and passage species present in spring and autumn.

This assemblage is also designated as part of the Severn Estuary SPA “internationally important assemblage of waterfowl” feature. The assessment carried out on the feature of the SPA is therefore relevant for the Ramsar site.

Conservation objectives

The conservation objective for the “internationally important assemblage of waterfowl” feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition, as defined by the conservation objective for the SPA “internationally important assemblage of waterfowl” feature (refer to section 10.2.3).

Toxic contamination

An assessment of the toxic effects of the FRR system outlet discharge has been carried out on the “internationally important assemblage of waterfowl” (refer to section 10.2.3) of the Severn Estuary SPA.

This assessment concluded that there will be no adverse effect on site integrity from the direct effect of toxic contamination.

Conclusion: toxic contamination

It is possible to conclude that there will be no adverse effect on site integrity alone on the “internationally important assemblage of waterfowl” of the Severn Estuary Ramsar from the effects of toxic contamination.

Nutrient enrichment

An assessment of the potential of the FRR system outlet discharge to result in nutrient enrichment has been carried out on the “internationally important assemblage of waterfowl” (refer to section 10.2.3) feature of the Severn Estuary SPA.

This assessment concluded that there will be no adverse effect on site integrity from the effects of nutrient enrichment.

Conclusion: nutrient enrichment

It is possible to conclude **no adverse effect** alone on the “internationally important assemblage of waterfowl” feature of the Severn Estuary Ramsar site from the effects of nutrient enrichment.

Smothering and habitat loss

An assessment of the potential of the FRR system outlet discharge to result in smothering and habitat loss of the supporting habitat of the “internationally important assemblage of waterfowl” been carried out on “internationally important assemblage of waterfowl” (refer to section 10.2.3) feature of the Severn Estuary SPA.

This assessment concluded that there will be no adverse effect on site integrity from the effects of smothering and habitat loss.

Conclusion: smothering and habitat loss

It is possible to conclude **no adverse effect** alone on the “internationally important assemblage of waterfowl” feature of the Severn Estuary Ramsar site from the effects of smothering and habitat loss.

10.3.5. Conclusion – Severn Estuary Ramsar appropriate assessment alone

It is therefore possible to conclude **no adverse effect** alone on the hard substrate (rocky shore, including eelgrass beds) habitat of the Severn Estuary Ramsar.

An in-combination assessment is required.

10.4. Sites with designated fish populations

An assessment is also required for migratory fish populations associated with other European sites that use the Severn Estuary SAC and Ramsar. Our screening exercise identified the following sites as requiring assessment: River Wye SAC and River Usk SAC.

River Wye SAC

- allis shad
- Atlantic salmon
- river lamprey
- sea lamprey
- twaite shad

River Usk SAC

- allis shad
- Atlantic salmon
- river lamprey
- sea lamprey
- twaite shad

Conservation objectives

The conservation objectives for the River Wye SAC as set by Natural England, are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the “favourable conservation status” of its qualifying features, by maintaining or restoring for qualifying species (relevant to this assessment):

- the populations of qualifying species

The conservation objectives for the River Wye SAC and the River Usk SAC as set by NRW, are to ensure that:

- the population of the feature in the SAC is stable or increasing over the long term

Appropriate assessment alone

The fish species designated as part of the River Wye SAC and River Usk SAC could only be affected by the FRR system outlet as they migrate through the Severn Estuary. An assessment of the potential for the discharge to impact migratory fish species has been carried out for the "migratory fish assemblage" of the Severn Estuary Ramsar, refer to section 10.3.2 of this report.

It was possible to conclude no adverse effect from the risks posed by the FRR system outlet – toxic contamination, nutrient enrichment and smothering and habitat loss.

10.4.1. Conclusion – River Wye SAC and River Usk SAC appropriate assessment alone

It is possible to conclude **no adverse effect alone** from the discharge of polluting matter on the River Wye SAC and River Usk SAC. There is no potential for toxic contamination, nutrient enrichment or smothering and habitat loss to prevent the conservation objectives from being met.

An in-combination appropriate assessment will be carried out on the sensitive features of the River Wye SAC and River Usk SAC.

10.5. Sites with designated bird populations

An assessment is required for local bird populations functionally linked to the Severn Estuary SPA and Ramsar. Our screening exercise identified the Somerset Levels and Moors SPA and Ramsar as requiring assessment.

Somerset Levels and Moors SPA

- Bewick's swan
- European golden plover
- northern lapwing
- teal
- waterbird assemblages

Somerset Levels and Moors Ramsar

- Bewick's swan
- northern lapwing
- teal
- waterbird assemblages

Conservation objectives

The conservation objectives for the Somerset Levels and Moors SPA are, with regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features'), and subject to natural change 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
- 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

These objectives will also be applied to the Somerset Levels and Moors Ramsar features.

The Somerset Levels and Moors SPA SACO (available here: European Site Conservation Objectives for Somerset Levels & Moors SPA - UK9010031 (naturalengland.org.uk)) states that "this SPA is ecologically linked to the Severn Estuary SPA with bird species notified as mobile qualifying features using either the inland or coastal European Sites as alternative winter feeding grounds according to weather conditions".

The same ecological linkage will also occur between the Somerset Levels and Moors Ramsar and the Severn Estuary SPA.

Appropriate assessment alone

The results of the assessment for the Severn Estuary SPA will be used in this appropriate assessment for the Severn Estuary SPA. The same supporting habitat of "Atlantic salt meadows" and "intertidal sandflats and mudflats" will be utilised by the bird populations associated with the Somerset Levels and Marshes SPA and Ramsar.

Section 10.2 of this HRA, the appropriate assessment alone for Severn Estuary SPA, concluded that there would be no adverse effect on the interest features of the SPA from the FRR system outlet discharge.

10.5.1. Conclusion Somerset Levels and Moors SPA and Ramsar appropriate assessment alone

It is therefore also possible to conclude **no adverse effect alone** on the Somerset Levels and Moors SPA and bird features of the Somerset Levels and Moors Ramsar.

An in-combination assessment is required.

10.6. Sites with designated marine mammal populations

An assessment is required for marine mammal populations functionally linked to the Severn Estuary SAC and Ramsar. Our screening exercise identified the Bristol Channel Approaches SAC as requiring assessment.

The harbour porpoise is a designated feature of the Bristol Channel Approaches SAC, with the area around HPC and the Severn Estuary SAC being used as functionally linked land (refer to section 4.3.9).

An ecological narrative is given in Appendix 2 of this HRA (Environment Agency, 2023b; Appendix 2).

Bristol Channel Approaches SAC has been designated because of its importance to harbour porpoise in the winter months (October to March) and is the closest harbour porpoise site to HPC. The Conservation Objectives and Advice on Operations (JNCC, March 2019) states that:

“This SAC has been selected primarily based on the long-term, relatively higher densities of porpoise in contrast to other areas of the MU. The implication is that the SAC provides relatively good foraging habitat and may also be used for breeding and calving. However, because the number of harbour porpoise using the site naturally varies (e.g., between seasons), there is no exact number of animals within the site.”

Conservation objectives

The conservation objectives for the Bristol Channel Approaches SAC is “to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters

In the context of natural change, this will be achieved by ensuring that:

- harbour porpoise is a viable component of the site
- there is no significant disturbance of the species
- the condition of supporting habitats and processes, and the availability of prey is maintained

Toxic contamination

The discharge of contaminants from terrestrial and offshore industries resulting in effects on water quality, is identified in the Bristol Channel Approaches SAC SACO (available here: advice on operations) as having a high risk of impact on the harbour porpoise. However, this relates to substances such as PCBs, which have been heavily regulated for many years or banned.

The discharge from the FRR system will not include the introduction of any contaminants, there will be no chemical dosing of the system.

The largest mixing zone to assess toxic contamination against is 9.78m² for unionised ammonia, and 0.064km² being needed to meet the oxygen demand through reaeration, as given in section 9.1.1. These predicted mixing zones do not consider tidal dispersion of the discharged matter, consumption of the matter by detritivores or scavengers, or the seasonality of the discharge and are therefore conservative.

This mixing zone is inconsequential when compared against the Celtic and Irish Seas MMMU.

Nutrient enrichment

Nutrient enrichment is not identified in the Bristol Channel Approaches SAC SACO (available here: advice on operations) as a risk to the harbour porpoise. The largest mixing zone to assess nutrient enrichment against is 0.56km² for organic enrichment, as given in section 9.1.2.

This mixing zone is inconsequential when compared against the Celtic and Irish Seas MMMU.

Smothering and habitat loss

Smothering and habitat loss are not identified in the in the Bristol Channel Approaches SAC SACO (available here: advice on operations) as a risk to the harbour porpoise.

Figure 4 indicates that matter from the FRR system is predicted to be beached on the intertidal and circalittoral rock habitat and will not enter the deeper waters of the estuary.

10.6.1. Conclusion – Bristol Channel Approaches SAC appropriate assessment alone

It is therefore possible to conclude **no adverse effect** on the harbour porpoise feature of the Bristol Channel Approaches SAC alone.

An in-combination assessment is required.

11. Appropriate assessment alone conclusion

It was possible to conclude no adverse effect on site integrity alone for all the European sites considered in this appropriate assessment:

Sites with direct connectivity to the discharge

- Severn Estuary SAC
- Severn Estuary SPA
- Severn Estuary Ramsar

Sites with designated fish species

- River Wye SAC
- River Usk SAC

Sites with designated bird populations

- Somerset Levels and Moors SPA
- Somerset Levels and Moors Ramsar

Sites with designated marine mammal populations

- Bristol Channel Approaches SAC

These sites and their relevant designated features will progress to the in-combination assessment stage.

12. In-combination assessment

Regulation 63 of the Conservation of Habitats and Species Regulations 2017 requires the competent authority to consider within the HRA, any permission, plans or projects (including Environment Agency permissions and plans/projects) that are likely to have a significant effect on a European site, either alone or in combination with other permissions, plans or projects. Where permissions indicate a likely significant effect, these will be assessed in combination with each other and with other relevant plans and projects.

In-combination effects can be one of the following:

- additive - the total effect of several effects is equal to the sum of the individual effects
- synergistic - the effect of the interaction of several effects is greater than the sum of the individual effects
- neutralistic - the effects counteract each other, reducing the overall effect
- overlapping - affecting the same spatial area of a feature and/or the same attributes of the feature. For example, the mixing zones of two separate discharges overlap
- discrete - affecting different areas and different attributes of the feature. For example, two separate discharges affect geographically discrete areas of a habitat within a site. In combination, the total area of habitat affected may be unacceptable in terms of site integrity

The assessment will consider the following (taken from PINS advice note 10, v9 2022, available here: Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects | National Infrastructure Planning (planninginspectorate.gov.uk)):

- projects that are under construction
- permitted application(s) not yet implemented
- submitted application(s) not yet determined
- projects on the National Infrastructure's programme of projects
- projects identified in the relevant development plan (and emerging development plans – with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited and the degree of uncertainty which may be present

This will also include within project or interlinked decisions in combination from the HPC project itself, where applicable.

The key aspects for consideration for in-combination effects are:

- the temporal and geographic boundaries of the effects of activities
- the interactions between the activities and the overall ecosystems
- the environmental effects of the project, and past and future projects and activities

- the thresholds of sensitivity of the existing environment

To be considered within the in-combination assessment other permissions, plans or projects should meet the following criteria:

- generate their own residual impacts of at least minor significance
- be likely to be constructed or operate over similar time periods
- be spatially linked to the proposed development (for example using the same local road network)

The in-combination assessment will be carried out on the closest European sites to HPC where we are able to conclude no adverse effect on site integrity alone. There is no requirement to carry out an in-combination assessment on sites where we have been unable to conclude no adverse effect on site integrity alone.

Should we be able to conclude no adverse effect in-combination on site integrity for the Severn Estuary SAC, SPA and Ramsar, the same conclusion will be inferred for the remaining European sites.

12.1. Identification of sites and designated features for consideration in the in-combination assessment

The alone assessment concluded that for the following sites the specified features had effects that were of sufficient magnitude to trigger an in-combination assessment.

- Severn Estuary SAC: all designated features
- Severn Estuary SPA: all designated features
- Severn Estuary Ramsar: all designated features
- River Wye SAC: Atlantic salmon, river lamprey, sea lamprey, allis shad and twaite shad
- River Usk SAC: Atlantic salmon, river lamprey, sea lamprey, allis shad and twaite shad
- Somerset Levels and Moors SPA: all designated features
- Somerset Levels and Moors Ramsar: all designated bird features
- Bristol Channel Approaches SAC: harbour porpoise

12.2. Identification of relevant PPP

To ensure that the list to be considered for the in-combination assessment is appropriate we have regard to:

- whether the PPP was a construction or works project that is now complete - if so, the PPP will have already been considered as part of the prevailing environmental conditions (through monitoring of environmental parameters such as temperature, nutrients etc.) and effectively taken into consideration in the alone assessment. As a result, it will not be considered further in the in-combination assessment to avoid double counting

- whether the PPP is an ongoing permission and also those that could potentially be revoked or changed in future - if so, the PPP has been considered in the in-combination assessment if a potential pathway or mechanism for in combination effects could be identified
- if there is a potential pathway or mechanism for in combination effects. If none could be identified, then the PPP will be excluded from consideration.

Identified mechanisms for in combination effects include:

- zones of overlap between similar effects on an interest feature arising from different PPPs (for instance overlapping habitat loss)
- zones of overlap of different types of effect arising from different PPPs (for example thermal plumes and toxic plumes overlapping)
- the cumulative effects of different PPPs acting in different locations on the same interest feature, leading to a potential adverse effect on the interest feature in terms of the proportion of the total resource of that interest feature within the SAC that is affected

This is consistent with the approach taken in the HRA for the HPC permit application. (Environment Agency, 2013).

Permissions, plans and projects were identified in the HRA to support the original HPC permitting process (Environment Agency, 2013), a review of permits issued by us as a competent authority (CA), and through our consultation with other CAs undertaken in January 2023. Consideration will also be given to within project in-combination effects, that is the potential for this variation to act in combination with the existing environmental permits for the construction and operation of HPC.

The list of CAs consulted is provided below and includes those CAs within the Bristol Channel and its approaches and Severn Estuary.

Defra organisations:

- Marine Management Organisation
- Natural England

Welsh bodies:

- Natural Resources Wales

Inshore Fisheries and Conservation Authorities (IFCA):

- Devon and Severn

Ports and Harbour Authorities:

- Bristol Port Company
- Cardiff Harbour Authority

Local authorities:

- Bristol City Council

- Cornwall Council
- Devon County Council
- North Devon Council
- North Somerset Council
- Sedgemoor District Council
- Somerset County Council
- Somerset West and Taunton Council
- South Hams District Council
- West Devon District Council
- Bridgend Council
- Cardiff Council
- Carmarthenshire Council
- Monmouthshire Council
- Neath Port Talbot Council
- Newport Council
- Pembrokeshire Council
- Swansea Council

Of the CAs identified above, responses were received from Natural Resources Wales and Natural England. For the remaining it must be assumed that there are no relevant PPP to be considered in combination.

NRW responded to the competent authority consultation on the 7 February 2023, they identified the following PPP for consideration in-combination with the permit variation:

- planned Celtic Sea floating offshore wind projects
- Severn Thames transfer
- Cardiff coastal defences
- HPC marine works
- Blue Eden tidal lagoon in Swansea Bay
- META phase 1 and 2, Milford Haven
- Severn Estuary elver fishery

NRW added the Severn Estuary elver fishery to their recommended PPP for the in-combination assessment on 17 February 2023.

NE responded to the competent authority consultation on the 8 February 2023, they identified the following PPP as being within scope for an in-combination assessment with the proposed variation:

- MMO South West Marine Plan
- Marine aggregate extraction operations within the Estuary

- Avonmouth Severnside enterprise area ecology mitigation and flood defence project
- Black Rock lave net fishery
- Bridgwater tidal barrier
- Hinkley Point C licensed marine works
- River Severn to River Thames transfer scheme

12.2.1. Assessment of the potential for an in-combination effect with existing HPC permits

An in-combination assessment is required to determine if there is the potential for an adverse effect on site integrity when considering the permitted activities assessed as part of Appropriate Assessment for the related Environment Agency operational permissions as determined in 2013 (Environment Agency, 2013), subsequent permit applications and variations and the current WDA permit variation.

The risks associated with the inclusion of the FRR system outlet in the operational WDA permit are toxic contamination, nutrient enrichment, smothering and associated habitat loss. These risks will therefore be considered in the within-project following in-combination assessment.

The FRR system will be in use during the hot functional testing, or commissioning, and operation of HPC. Permits required for the construction of HPC will be assessed to determine if there will be a residual effect that could act in-combination with the FRR system outfall.

Permits required for the construction of HPC

Construction water discharge activity permits

There have been 2 further WDA permits issued to the company for use during the construction of HPC:

- JP3122GMv007, temporary construction discharge
- XP3321GD, sewage treatment plant

There will be no temporal overlap between the operational phase of HPC and these permits. Once HPC is operational the sewage treatment plant effluent will be discharged via the cooling water system outfall.

Due to the tidal nature of the Severn Estuary and the dilution available to these discharges, there is not potential for any residual effects to act in-combination with the FRR system outlet discharge.

It is possible to conclude no adverse effect in-combination with JP3122GMv007 and XP3321GD.

Construction combustion activity permit

Permit number: WP3200PJ

The HPC construction site operates sufficient mobile generating equipment to require an environmental permit due to the aggregated rated thermal input of combustion equipment on site. The engines are in place to provide electricity to allow the construction site to operate.

At the time of the assessment for this permit application (Environment Agency, 2019) the site included 152 mobile diesel generators and 92 non-road mobile machinery, ranging from 22 kVA to 715 kVA (i.e., 24 to 658 kWe). A 35% uplift on the generator emissions was added to the baseline. The headroom was intended to allow for a reasonable degree of flexibility in the delivery of the HPC construction programme, accounting for peaks in activity on the HPC Site and therefore associated emissions.

The HRA identified a key environmental improvement for the HPC project being the completion and implementation of the construction electrification supply project. Once fully installed this will provide 35MVA of low carbon installed power capacity to the site from Hinkley Point B. This will be available to approximately 85% of the construction site via energised substations and feeder pillars.

The number of generators on site will decrease significantly as more areas of the site are connected to the National Grid with a subsequent decrease in any potential ecological impacts.

The LSE screening assessment identified a likely significant effect alone on all features of the Severn Estuary SAC, Severn Estuary SPA and Severn Estuary Ramsar from the effects of nutrient enrichment and toxic contamination.

There will be no temporal in-combination effect between the combustion activity permit and the proposed WDA permit variation. Construction of the power plant will have completed prior to the discharge of polluting matter from the FRR system outlet which will only occur once the power station is operational. This assessment will therefore determine whether there is the potential for any residual effects from the combustion activities that could act in-combination with the proposal.

Modelling carried out for the appropriate assessment to support the construction combustion activity permit predicted that deposition of nutrient nitrogen on the “Atlantic salt meadows” would be 0.5% of the critical load of 30kg N/ha/yr (Site Relevant Critical Loads and Source Attribution | Air Pollution Information System (apis.ac.uk)).

We do not expect that this low level of deposition to a habitat that is tidal and regularly inundated would result in any residual effects that could act in-combination with nutrients from the FRR system outlet. The alone assessment for the Atlantic salt meadows (refer to section 10.1.7) concluded that the discharge will be fully dispersed to levels well below those that will result in nutrient enrichment at the nearest “Atlantic salt meadows” habitat.

The remaining SAC features are either not sensitive to nutrient enrichment, or there is no comparable habitat with an established critical load (Site Relevant Critical Loads and Source Attribution | Air Pollution Information System (apis.ac.uk)).

The potential for direct toxic effects from NOx emissions were also assessed

It is possible to conclude no adverse effect in-combination with WP3200PJ, construction combustion activity.

Conclusion of the potential for an in-combination effect with permits required for the construction of HPC

It has been possible to conclude **no adverse effect** in-combination with any of the environmental permits required to build HPC.

Permits required for the operation of HPC

Operational water discharge activity permit

HP3228XT

It is proposed to discharge the various process effluents into the main cooling water flow, prior to discharge to the Bristol Channel. The outlet is located approximately 1.8km offshore. This provides a significant initial dilution of chemicals before they reach the environment. The plant has been specifically designed to ensure that live fish leaving the FRR system outlet close to shore do not enter toxic plumes from the cooling water discharge.

The discharge from the cooling water system outlet can be characterised as follows:

Waste stream A - seawater abstracted for direct cooling of the condensers and various other plant systems. Passed once through the cooling water system and discharged via the outfall tunnel with the addition of waste heat and possibly total residual oxidant (TRO) as a consequence of bio-fouling control.

Waste streams B, C and D - chemicals associated with various dosing processes used to condition the primary circuit, the secondary circuit and the nuclear and conventional auxiliary circuits. Dosing is primarily required to control pH levels and eliminate oxygen, thus reducing the potential for corrosion within the circuits and the production of corrosion products. Dosing chemicals used in the UK EPR reactor include lithium hydroxide, ammonia, morpholine, ethanolamine and hydrazine. Additionally, boric acid is used as a neutron absorber within the primary circuit to control reactivity.

To maintain the correct chemistry within the secondary circuit there is a continual bleed known as blowdown from the steam generators and a corresponding top up with fresh demineralised water.

Leakage and/or drainage (not blowdown) from the secondary circuit and other systems within the turbine hall and the floor drains therein are also included within waste streams B, C and D.

Waste stream E - water contaminated with oils, greases and hydrocarbons from areas that contain back-up diesel generators, transformers, electrical substations, oil and fuel offloading facilities; stores and workshops.

Waste stream F - waste water from the demineralisation process used to produce demineralised water, using a combination of membrane technology and ion exchange processes. The effluent generated will contain various contaminants including iron, chloride, suspended solids, sulphates, sodium, phosphates, acetic and phosphoric acid.

Waste stream G - domestic sewage arising from staff welfare facilities across the site and treated in an on-site sewage works prior to discharge. The effluent is characterised by biochemical oxygen demand (BOD), suspended solids and ammonia.

There is the potential for toxic contamination, siltation and associated habitat loss from waste streams being discharged and they are therefore relevant for an in-combination assessment. They will be discharged via the cooling water system outlet.

The in-combination assessment carried out for the operational WDA permit (Environment Agency, 2013, section 6.5.2) stated that:

“The only waste streams and contaminants which are considered to have a likely significant effect are the excess temperature and TRO in waste stream A, and hydrazine and morpholine in waste stream B, C, and D. No other contaminants in any of the other waste streams are considered to have a likely significant effect on the integrity of the Severn Estuary SAC.”

Waste stream G is the sewage treatment works discharge, it is therefore possible to conclude no in-combination effect that would result in nutrient enrichment of the Severn Estuary SAC, SPA and Ramsar.

The assessment also discounted suspended solids from further assessment, it is therefore possible to conclude no in-combination effect that would result in siltation and resulting habitat loss of any features of the Severn Estuary SAC, SPA and Ramsar.

The HRA concluded that a requirement was placed on the WDA permit requiring that hydrazine be removed from the waste streams before disposal. The applicant has started initial discussions with us on a variation to the WDA permit to permit the discharge of hydrazine. These discussions are not far enough advanced to include in this in-combination assessment. The HRA for the WDA permit variation to include hydrazine will consider the potential for in-combination effects with the FRR system outlet discharge.

There will be no discharge of heated water from the FRR system outlet, therefore there is no potential for a direct in-combination effect. However, there is the potential that there could be a synergistic in-combination effect between the discharge of heated water from

the cooling water system and the FRR system outlet discharge. An assessment will therefore be made to assess whether there will be any overlap of the discharge of warmed water from the cooling water system and the FRR system outlet discharge.

TRO in-combination assessment

As the levels of TRO exceeded its respective target in the discharge of cooling water, there was a need to define the extent of the contaminant plume, and the areas at the sea surface and seabed where the relevant target is exceeded; that is the size of the mixing zones. If these mixing zones have the potential to overlap, consideration will need to be given as to whether this would then lead to an adverse effect on the Severn Estuary SAC, SPA and Ramsar.

The size of the mixing zones for HPB and HPC are shown in Figure 11 for the discharge of TRO. Both plumes are elliptical in shape running in parallel with the shoreline, however the TRO discharge is off-shore and does not have the potential for a spatial in-combination effect with the FRR discharge.

The approach to modelling the FRR system discharge also does not take account of dispersal, accumulation, or consumption by detritivores. Our figures are thought to provide a worst-case acute impact. In the dynamic environment of Bridgwater Bay and the Severn Estuary, dispersal could be quite large, reducing further the potential for an overlapping in-combination effect.

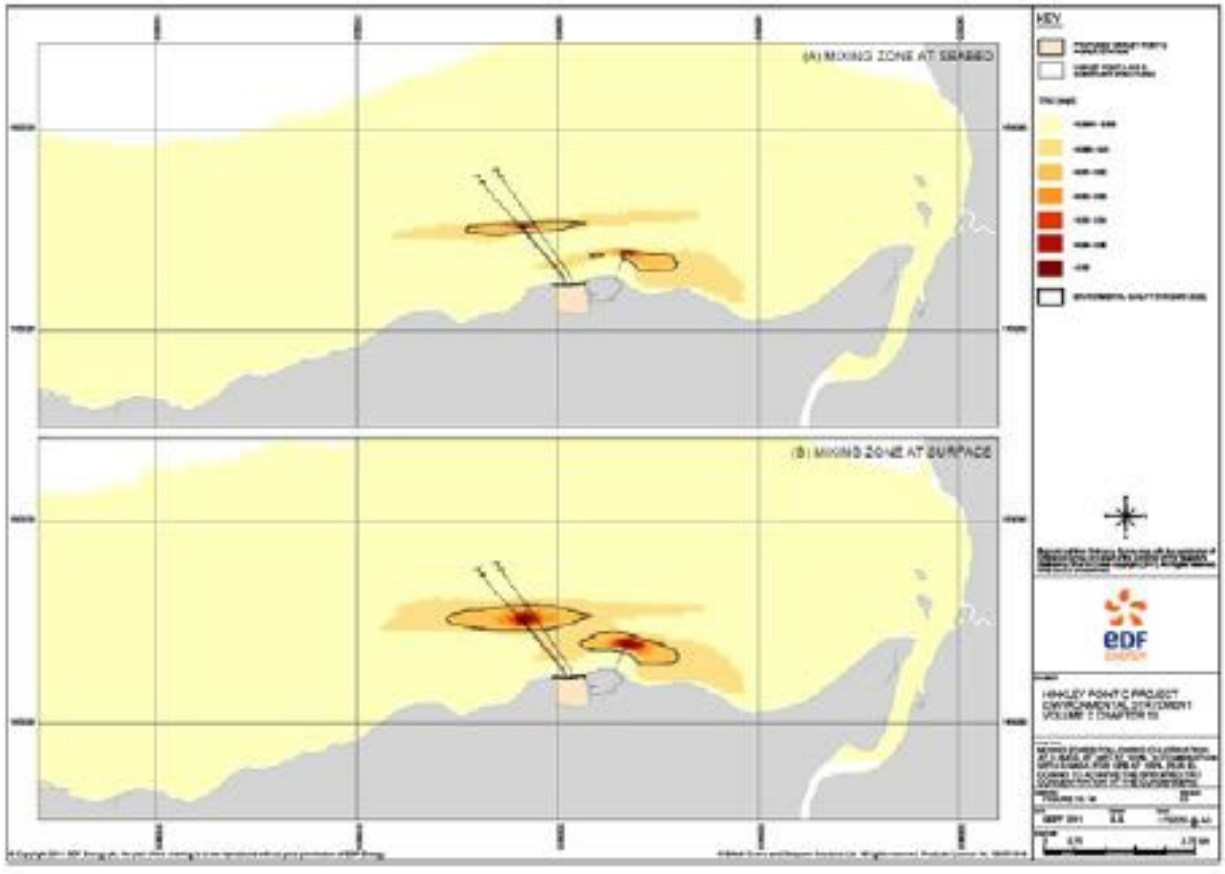


Figure 11 HPB and HPC TRO mixing zones at seabed (top) and surface (bottom) (taken from HPC Project Environmental statement, Volume 2 (NNBGenCo, 2011))

Consideration should therefore be given to the potential for a discrete in-combination effects. The TRO mixing zone is predicted to cover 139ha or within the SAC at the surface, and 60ha at the bed. This equates to 0.189% of the “estuaries” feature of the SAC at the surface and 0.081% at the bed. The toxic contamination assessment (refer to section 9.1.1 of this report) resulted in an area of:

- 9.78m² being required to meet the EQS for unionised ammonia
- 0.064km² being needed to meet the oxygen demand through reaeration

The Severn Estuary SAC and “estuaries” feature covers an area of 73714.11ha, given the predicted scale of both plumes in relation to the size of the SAC, it is possible to conclude no adverse effect in-combination. The same conclusion can be made for the Severn Estuary Ramsar “estuaries” feature, and the features of the Severn Estuary SPA and Ramsar that are supported by the SAC habitat.

Thermal discharge in-combination assessment

Once the cooling water is discharged through the outfall, its temperature falls rapidly as a result of dilution and loss to the atmosphere. Very high temperatures will therefore only occur within the cooling water in the outfall tunnels downstream of the condensers.

The applicant assessed the impact of thermal uplift from cooling water discharges associated with HPB (there was an assumption that there would be an overlap in the operation of HPB and HPC, this is no longer the case) and HPC on the area that would be required for ammonia to meet its EQS. This followed the same methodolgies as set out in section 9.

The results of this assessment are provided in Table 6, the area required for ammonia to meet its EQS in-combination with the thermal discharge from HPB and HPC cooling water systems is predicted to be a maximum of 11.4m². The actual in-combination effect is expected to be lower as HPB is no longer operational.

Table 6 Calculations of the volume of seawater required to dilute this mass of ammonia to the environmental quality standard (EQS) with temperature uplift

Unionised ammonia	December daily average (TR515v2)	December daily average, TR515v2 species (EA)	June daily maximum, TR515v2 species (EA)	December daily average – all fish (EA)	December daily average – all fish and inverts (EA)
Total NH_4 (mg)	16,950	30,237	55,167	57,681	61,175
Unionised ammonia from calculator with temperature uplift (mg)	407.48	727	1,326	1,387	1,471
Volume required to dilute to the EQS with temperature uplift (l)	22,110	39,441	71,961	75,240	79,797
Area required to reach EQS with temperature uplift (m^2)	2.05	5.63	10.28	10.75	11.40

It is unlikely that an in-combination effect of 11.4m, a rise from 9.78m alone will result in an adverse effect when compared to the scale of the Severn Estuary SAC, SPA and Ramsar and their designated features.

Conclusion: TRO and thermal discharge

It is possible to conclude no adverse effect in-combination with HP3228XT, operational water discharge activity.

Operational combustion activity (CA) permit

Permit number: ZP3238FH

The Hinkley Point C Installation requires a permit and consists of twelve back-up diesel generators which have a combined net thermal input of 176 MWth, associated fuel storage tanks and interconnecting pipework. The generators will be housed in four purpose built concrete buildings each containing two 18.5 MWth essential diesel generators and one 7 MWth station blackout diesel generator.

The diesel generators are safety classified standby equipment and will only be operated in the event of a power failure and during periodic testing.

There is the potential for an in-combination effect during the commissioning or testing of the diesel generators and hot functional testing of the reactors, which will require cooling water, and the operation of HPC.

Modelling of SO_2 and NOx emissions for the commissioning of HPC (Environment Agency, 2013) indicated that the predicted environmental concentration, or the emissions plus background, would be below the protective critical level of 30µg/m^3 (65% of the critical level) for NOX and 20µg/m^3 for SO_2 (15% of the critical level). It was concluded that there would be no likely significant effect on the Severn Estuary SAC, SPA and Ramsar, and no further assessment was made.

Maximum modelled nutrient deposition was predicted to be 0.8kg N/ha/yr or 4% of the critical load for the “Atlantic salt meadows” feature of the SAC, with a predicted environmental concentration of 13.7kg N/ha/yr or 68% of the critical load. It was concluded that there would be no likely significant effect on the Severn Estuary SAC, SPA and Ramsar, and no further assessment was made.

Emissions and deposition during the routine operation of HPC will be lower than during its commissioning, the diesel will only be in operation during routine maintenance and loss of power. A conclusion of no likely significant effect was also made for the predicted emissions of SO_2 and NOx and nutrient deposition for the routine operation of HPC on the Severn Estuary SAC, SPA and Ramsar, and no further assessment was made.

It is not considered that contributions below the likely significant effect threshold will have the potential to act in-combination with the FRR system outfall discharge and result in an adverse effect on the sensitive features of the Severn Estuary SAC and Ramsar, and the features of the Severn Estuary SPA and Ramsar that they support. Those features that are sensitive to aerial emissions are inter-tidal, any contributions to nutrient enrichment and toxic contamination from the operation of the diesel generators will be inconsequential when considering the scale of the SAC and turbidity of the Severn Estuary.

It is possible to conclude no adverse effect in-combination with ZP3238FH, operational combustion activity.

Radioactive substances regulations (RSR) permit

Permit number: ZP36390SY

Radioactive waste would be produced by activities associated either directly or indirectly with operating and maintaining the nuclear reactors at HPC. The operation and maintenance of the HPC power station would produce solid, aqueous, and gaseous radioactive waste, some of which would be discharged to the environment.

There is no potential for an in-combination effect between the radioactive waste discharges from HPC power station and the FRR system outlet. There is no common risk, there will be no radiological discharges from the FRR system.

There is no potential for an in-combination effect between the RSR permit and the WDA variation application.

Conclusion of the potential for an in-combination effect with permits required for the operation of HPC

It has been possible to conclude **no adverse effect** in-combination with any of the environmental permits required to commission and operate HPC.

12.2.2. PPP identified in the HRA to support the HPC development (2013)

The HRA carried out for HPC in 2012 identified several PPP for an in-combination assessment, based on the criteria set out above, with the same potential risks as those identified for the current variation. Due to the time between the permitting of HPC (determined in 2013) and this permit variation, it is likely that these PPP are part of the prevailing environmental conditions or baseline.

Hinkley Point B

HPB ceased operating in August 2022. There are ongoing trade and sewage discharges to the Severn Estuary, which are now part of the baseline and the prevailing environmental conditions within the Severn Estuary. The baseline was considered when carrying out the assessment of the cooling water system discharge, which has been assessed in combination with the FRR system outlet discharge in section 12.2.1 of this report.

Hinkley Point A decommissioning

HPA ceased generation in 2000 and is currently being de-fuelled and decommissioned. There is an ongoing trade effluent discharge (issued July 2016) for HPA, which are now part of the baseline and the prevailing environmental conditions within the Severn Estuary. The baseline was considered when carrying out the assessment of the cooling water system discharge, which has been assessed in combination with the FRR system outlet discharge in section 12.2.1 of this report.

Oldbury Nuclear Power Station (Oldbury A)

Oldbury Nuclear Power Station ceased operating in 2012. There are ongoing trade discharges to the Severn Estuary which are now part of the baseline and the prevailing environmental conditions within the Severn Estuary. The baseline was considered when carrying out the assessment of the cooling water system discharge, which has been assessed in combination with the FRR system outlet discharge in section 12.2.1 of this report.

Environment Agency Steart Coastal Management Project

This coastal realignment project has completed and is now considered to be a part of the prevailing environmental conditions.

This project is not relevant for assessment.

Bristol Deep Sea Container Terminal (BDSCT) (Dredging)

This is a proposal for a deep-sea container terminal 45km north of the proposed development of HPC. The company are currently waiting for 'global economic conditions to improve' prior to commencing development. Bristol Port Company has therefore applied for a ten-year extension, with consent now valid until 2030.

The activity most relevant to the HPC development in-combination assessment is the dredging proposal. Maintenance dredging would require removal of muddy and sandy sediments that accumulate in the turning area and berths. Muddy sediments would be deposited locally, and sediments deposited at the new deep water disposal site at Holm Deep.

In total, the proposal, once commenced, has the potential for an increase of 20cm of silt in Bridgwater Bay over 3 years.

This project is relevant for assessment.

Compensation habitat creation at Steart for the Bristol deep sea container terminal

Bristol Port Company proposed compensatory habitat on the Steart peninsula as a result of its consented port expansion at Avonmouth. Steart marshes coastal realignment project has completed and is now considered to be a part of the prevailing environmental conditions.

This project is not relevant for assessment.

Development of a new nuclear power station at Oldbury, Gloucestershire

The draft National Policy Statement for Nuclear Energy identifies a site immediately northeast of the existing Oldbury nuclear power station as a potential site for development of a new nuclear power station. The site was being progressed by Horizon Nuclear Power

Ltd, however the company is no longer developing this power station. A statement confirming this is available via their website: Homepage - Horizon Nuclear Power

This project is not relevant for assessment.

Temporary jetty

The construction of the jetty has been completed, and it is expected to be operational for 7.5 years during the construction period for HPC.

The construction water discharge activity permit (CWDA) was varied in 2018 to include the jetty discharge (CWDA EPR/JP3122GM V007). This discharge will cease prior to the operation of HPC, there will be no potential for an in-combination effect.

This project is not relevant for assessment.

Flood wall construction

The construction of the flood wall will be completed prior to the operation of HPC, there will be no potential for an in-combination effect.

This project is not relevant for assessment.

Conclusion of in-combination assessment with PPP identified in the HRA to support the HPC development (2013)

It has been possible to conclude **no adverse effect** in-combination with any of the PPP identified in the original HRA for HPC (Environment Agency, 2013).

12.2.3. PPP identified by other competent authorities

MMO south west marine plan

The south west inshore marine plan area covers an area of approximately 2,000 kilometres of coastline stretching from the River Severn border with Wales to the River Dart in Devon, taking in a total of approximately 16,000 square kilometres of sea. The south west offshore marine plan area includes the area from 12 nautical miles extending out to the seaward limit of the Exclusive Economic Zone, a total of approximately 68,000 square kilometres of sea.

The south west marine plan can be found here: South West Inshore and South West Offshore Marine Plan (publishing.service.gov.uk)

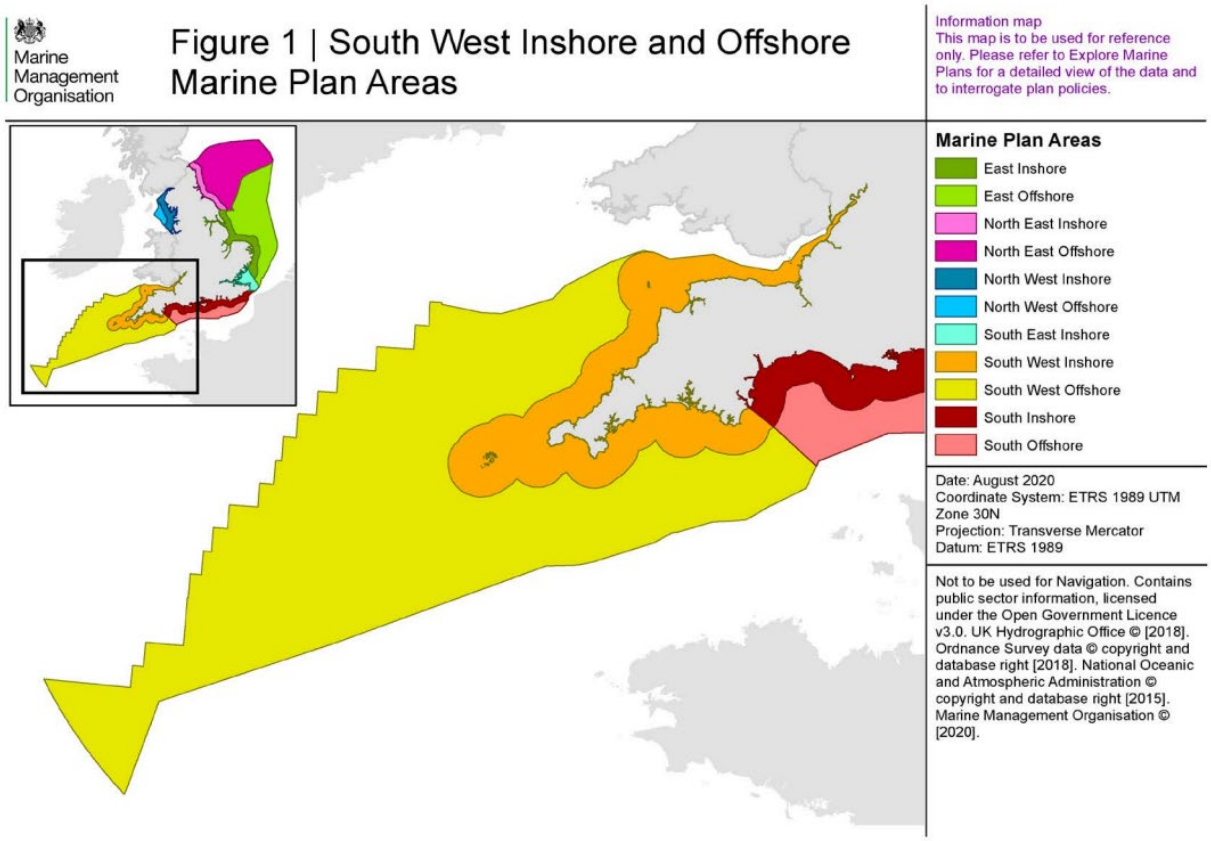


Figure 12 South west inshore and offshore marine plan areas. MMO, 2021

An appropriate assessment information report (AAIR) was completed by the MMO covering all of their marine plans, including the south west plan. It can be found here: AAIR_final.pdf (publishing.service.gov.uk).

The AAIR identifies the following risks that could result in an in-combination effect with the proposed FRR system outlet discharge:

- physical loss (of habitats) from removal or smothering
- toxic contamination toxic contamination from the introduction of synthetic compounds, introduction of non-synthetic compounds
- non-toxic contamination from nutrient enrichment, organic enrichment

The AAIR concluded that:

“Three key policy measures are proposed to provide the necessary assurances that the marine plans as a whole will have no adverse effect on the integrity of European and Ramsar sites either alone or in-combination with other plans or projects. These are as follows:

Explicitly enshrining the requirement for project-level HRA in the marine plans – since it is not possible to rule out adverse effects on the integrity of many European sites due simply to the high level nature of the marine plan policies, ‘down-the-line’ assessment becomes essential.

Consideration of matters that cross the terrestrial/marine environment planning borders when determining the acceptability of schemes

A monitoring and Iterative Plan Review (IPR) provision”

It is considered that, due to these measures that have been put in place through the AAIR of the MMO’s south west marine plan, there is no potential for an in-combination effect with the HPC permit variation. Any future marine licences issued by the MMO in the south west would be required to consider FRR system outlet discharge in their HRA in-combination assessment.

There is no potential for an in-combination effect between the south west marine plan and the WDA variation application.

Licensed activities at disposal sites within the Severn Estuary

Dredged muds can be disposed of within the Severn Estuary subject to the necessary licences from the MMO for disposal within English waters and Natural Resources Wales for disposal within Welsh waters. The dredged muds are dispersed and redistributed naturally by the strong tidal currents of the estuary.

The discharge from the FRR system is localised along a small stretch of the Severn Estuary coast (12km), it is unlikely that there will be any in-combination effects with existing or planned dredging activities.

There is no potential for an in-combination effect between licensed activities and the WDA variation application.

HPC licensed marine works

These have been assessed as part of the within project in-combination assessment, refer to section 12.2.2 of this HRA.

Avonmouth Severnside Enterprise Area ecology mitigation and flood defence project

The Avonmouth Severnside Enterprise Area ecology mitigation and flood defence project is the biggest project of its type in the west of England. The project area stretches from Lamplighter’s Marsh, which lies at the mouth of the Severn Estuary on the flood plain of the River Avon, to Aust Cliff, which is directly under the English end of the first Severn bridge. The work is estimated to be complete in 2026/27.

Further information is available via this link to their website: Avonmouth and Severnside Enterprise Area – Ecology Mitigation and Flood Defence Project (asea-flood-ecology.co.uk)

The FRR system will not be in use until HPC is commissioned, currently the operational WDA permit is required from November 2026. There is the potential for a small overlap with the flood defence project, however it is located more than 40km from HPC. Any

sediments released into the estuary during the construction of the flood defence scheme and associated mitigation will be rapidly dispersed in the tidal and turbid Severn. It is not expected that there would be any measurable effects at the FRR system discharge point and its surrounding habitat

There will be no in-combination effects between the Avonmouth Severnside Enterprise Area and HPC.

Bridgwater tidal barrier

The tidal barrier will be constructed across the River Parrett north of Bridgwater with gates that can be closed to prevent very high water levels travelling upstream and flooding property and infrastructure. The project is on track to be operational by 2024.

Further information is available by this link: Bridgwater tidal barrier progress - GOV.UK (www.gov.uk)

The FRR system will not be in use until HPC is commissioned, currently the operational WDA permit is required from November 2026. There will be no temporal overlap with the construction of the barrier.

Any sediments released into the estuary during the construction of the flood defence scheme and associated mitigation will be rapidly dispersed in the tidal and turbid Severn. It is not expected that there would be any measurable residual effects at the FRR system discharge point and its surrounding habitat.

There will be no in-combination effects between Bridgwater tidal barrier and HPC.

Cardiff coastal defences

Application number: 21/02304/MJR

Applications for a marine licence and planning approval were made in 2021 to enable the proposed fluvial and coastal flood defence along the Severn Estuary coastline at Cardiff and the east and west banks of the River Rhymney. The proposed works include the installation of a 2.1km long sloping rock armour revetment along the coastline and the installation of Dycel blocks and double layer rock armour toe along the bank of the River Rhymney.

A HRA was completed for the proposed coastal defences and can be accessed here: Cardiff Coastal Defences Report to Inform a Habitats Regulations Assessment.

Permission was granted in 2022.

Any sediments released into the estuary during the construction of the coastal defences will be rapidly dispersed in the tidal and turbid Severn. It is not expected that there would be any measurable residual effects at the FRR system discharge point and its surrounding habitat.

This project is not relevant for assessment.

Planned Celtic Sea Floating offshore wind projects

These include, for example, Erebus, Valorous, Llyr 1, and Llyr 2.

Erebus is due to be constructed in 2026, information is available here: Erebus | Blue Gem Wind

Valorous will follow on from Erebus, with planned installation 2028-2029, information is available here: Valorous | Blue Gem Wind

Llyr 1 and Llyr 2 projects are two separate 100mW sites that have advanced through the Crown Estate's test and demonstration leasing opportunity. If consent applications for their development are successful, construction of the floating platforms and infrastructure is anticipated to commence in 2024, with installation commencing in 2025/26.

There is the potential that contaminants in the seabed could be re-mobilised during construction of floating offshore wind projects, however any toxic contamination would be localised and readily dispersed. It is not expected that there would be any measurable residual effects at the FRR system discharge point and its surrounding habitat.

These projects are not relevant for assessment.

Blue Eden Tidal Lagoon in Swansea Bay

The Blue Eden tidal lagoon is a proposed 9.5km tidal structure which would be delivered in 3 phases over 12 years. However, there has been no engagement with NRW as the competent authority or SNCB for over 2 years. It is understood that pre-application advice might be sought soon, but currently there is not enough information available to inform an in-combination assessment.

This project is not relevant for assessment.

META Wales: Phase 1 and 2, Milford Haven

META consists of 8 pre-consented test sites for marine energy off the Pembrokeshire coast of Wales. Phase 1 consists of 5 sheltered quayside sites next to Pembroke Port, they opened in 2019. Phase 2 is made up of 3 sites further offshore, they became operational in Summer 2021.

Information is available here: About META - META Wales

The FRR system will not be in use until HPC is commissioned, currently the operational WDA permit is required from November 2026. There will be no temporal or spatial overlap with the META Wales project.

This project is not relevant for assessment.

Severn Thames Transfer

The Severn to Thames Transfer would transfer water from the north west and midlands to the south east of England for use during a drought. This water would come from the River Severn itself, with Severn Trent Water and United Utilities providing additional sources of water if needed. The water would then be moved from the River Severn to the River Thames either by a new pipeline or by a combination of new pipeline and restoring the Cotswold canals.

Information on the scheme is available here: Water transfers - Thames Water Resources Management Plan (thames-wrmp.co.uk) and gate-1-submission-stt.pdf (severntrent.com)

There is no potential for any of the construction activities associated with new pipelines adjacent to the River Severn to act in-combination with the discharge from the FRR system outlet. There will be no works within the Severn Estuary.

This project is not relevant for assessment.

Black Rock lave net fishery

Any HRA associated with the granting of permissions for the Black Rock lave net fishery would consider the taking of fish from the Severn Estuary. The risks associated with the inclusion of the FRR system outlet in the operational WDA permit are toxic contamination, nutrient enrichment, smothering and associated habitat loss. There is no mechanism for an in-combination effect.

This project is not relevant for assessment.

EA salmon net limitation order licences

Any HRA associated with the granting of the EA net limitation order licences would consider the taking of salmon from the Severn Estuary. The risks associated with the inclusion of the FRR system outlet in the operational WDA permit are toxic contamination, nutrient enrichment, smothering and associated habitat loss. There is no mechanism for an in-combination effect.

This project is not relevant for assessment.

Severn Estuary elver fishery

Any HRA associated with the granting of permissions for the Severn Estuary elver fishery would consider the taking of elvers from the Severn Estuary. The risks associated with the inclusion of the FRR system outlet in the operational WDA permit are toxic contamination, nutrient enrichment, smothering and associated habitat loss. There is no mechanism for an in-combination effect.

This project is not relevant for assessment.

13. Conclusion of the appropriate assessment

The appropriate assessment for the variation to the operational WDA permit has been carried out in section 7 which described the risks associated with the FRR system outlet discharge, in section 9 which described the AA methodology, and in section 10 which considered water quality effects on the relevant designated features of the European sites. The potential for in-combination effects was covered in section 12.

The results of the appropriate assessment will be considered in the integrity tests set out here in section 13.1.

13.1. European site integrity test

Regulation 63(3) of the Habitats Regulations requires that a competent authority "may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site."

Managing Natura 2000 sites advice (European Commission, Directorate-General for Environment, 2019) explains the concept of the "integrity of the site" at section 4.6.4 as the "coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated." The following section takes the information already assessed and reaches conclusions on European site integrity.

13.1.1. Severn Estuary SAC

This integrity test is concluded with regard to the conservation objectives which can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

Full consideration was given to the targets relating to water quality that were provided in the Regulation 33 conservation advice package (Natural England and CCW, 2009). These targets were used to inform the appropriate assessment for the Severn Estuary SAC in section 10.1 of this HRA.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect was identified, the operational WDA will not breach the relevant assessment criteria for the following:

- nutrient enrichment
- toxic contamination

There is no potential for smothering and indirect habitat loss of the designated habitats.

A conclusion of no adverse effect was made alone and in combination for all of the features of the Severn Estuary SAC.

Managing Natura advice (Commission Notice, 2019) explains the concept of the “integrity of the site” at section 4.6.4 as the “coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”

We do not believe that the variation to the operational WDA permit will impact upon the Severn Estuary SAC’s ecological structure, function and ecological processes across its whole area.

We were able to reach this conclusion due to the modelling results confirming that the polluting potential of the discharge would be too small to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other PPP.

13.1.2. Severn Estuary SPA

This integrity test is concluded with regard to the conservation objectives which can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

Full consideration was given to the targets relating to water quality that were provided in the Regulation 33 conservation advice package (Natural England and CCW, 2009). These targets were used to inform the appropriate assessment for the Severn Estuary SPA in section 10.2 of this HRA.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect was identified, the operational WDA will not breach the relevant assessment criteria for the following:

- nutrient enrichment
- toxic contamination

There is no potential for smothering and indirect habitat loss of the supporting habitats of the designated bird populations.

A conclusion of no adverse effect was made alone and in combination for all the features of the Severn Estuary SPA.

Managing Natura advice (Commission Notice, 2019) explains the concept of the “integrity of the site” at section 4.6.4 as the “coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”

We do not believe that the variation to the operational WDA permit will impact upon the Severn Estuary SPA’s ecological structure, function and ecological processes across its whole area.

We were able to reach this conclusion due to the modelling results confirming that the polluting potential of the discharge would be too small to undermine the achievement of

the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other PPP.

13.1.3. Severn Estuary Ramsar

This integrity test is concluded with regard to the conservation objectives which can be accessed via this link: http://publications.naturalengland.org.uk/file/3977366.

Full consideration was given to the targets relating to water quality that were provided in the Regulation 33 conservation advice package (Natural England and CCW, 2009). These targets were used to inform the appropriate assessment for the Severn Estuary Ramsar in section 10.3 of this HRA.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect was identified, the operational WDA will not breach the relevant assessment criteria for the following:

- nutrient enrichment
- toxic contamination

There is no potential for smothering and indirect habitat loss of the designated habitats and supporting habitats of the designated bird populations.

A conclusion of no adverse effect was made alone and in combination for all the features of the Severn Estuary Ramsar.

Managing Natura advice (Commission Notice, 2019) explains the concept of the “integrity of the site” at section 4.6.4 as the “coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”

We do not believe that the variation to the operational WDA permit will impact upon the Severn Estuary Ramsar’s ecological structure, function and ecological processes across its whole area.

We were able to reach this conclusion due to the modelling results confirming that the polluting potential of the discharge would be too small to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other PPP.

13.1.4. Sites with designated fish species

This integrity test is concluded with regard to the conservation objectives for the River Usk SAC and River Wye SAC as set by Natural England and Natural Resources Wales and provided in 10.4 of this HRA.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect was identified, the operational WDA will not breach the relevant assessment criteria for the following:

- nutrient enrichment
- toxic contamination

There is no potential for smothering and indirect habitat loss of the supporting habitats of the designated fish species.

A conclusion of no adverse effect was made alone and in combination for all the features of the River Usk SAC and River Wye SAC.

Managing Natura advice (Commission Notice, 2019) explains the concept of the "integrity of the site" at section 4.6.4 as the "coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated."

We do not believe that the variation to the operational WDA permit will impact upon the River Usk SAC's and River Wye SAC's ecological structure, function and ecological processes across its whole area.

We were able to reach this conclusion due to the modelling results confirming that the polluting potential of the discharge would be too small to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other PPP.

13.1.5. Sites with designated bird populations

This integrity test is concluded with regard to the conservation objectives which can be accessed via this link: European Site Conservation Objectives for Somerset Levels & Moors SPA - UK9010031 (naturalengland.org.uk).

Full consideration was given to the information provided in the SACO (Natural England, 2019) which were used to inform the appropriate assessment for the Somerset Levels and Moors SPA and Ramsar in section 10.5 of this HRA.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect was identified, the operational WDA will not breach the relevant assessment criteria for the following:

- nutrient enrichment
- toxic contamination

There is no potential for smothering and indirect habitat loss of the supporting habitats of the designated bird populations.

A conclusion of no adverse effect was made alone and in combination for all the features of the Somerset Levels and Moors SPA and Ramsar.

Managing Natura advice (Commission Notice, 2019) explains the concept of the “integrity of the site” at section 4.6.4 as the “coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”

We do not believe that the variation to the operational WDA permit will impact upon the Somerset Levels and Moors SPA and Ramsar’s ecological structure, function and ecological processes across its whole area.

We were able to reach this conclusion due to the modelling results confirming that the polluting potential of the discharge would be too small to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other PPP.

13.1.6. Sites with designated marine mammal populations

This integrity test is concluded with regard to the conservation objectives which can be accessed via this link: Bristol Channel Approaches / Dynesfeydd Môr Hafren MPA – Relevant Documentation & Conservation Advice | JNCC Resource Hub.

Full consideration was given to the targets provided in the advice on operations (JNCC and NE, 2019) to water quality, which were used to inform the appropriate assessment for the Bristol Chanel Approaches SAC in section 10.5 of this HRA.

This appropriate assessment has determined that, for those aspects of the permit where a likely significant effect was identified, the operational WDA will not breach the relevant assessment criteria for the following:

- nutrient enrichment
- toxic contamination

A conclusion of no adverse effect was made alone and in combination for all the features of the Bristol Chanel Approaches SAC.

Managing Natura advice (Commission Notice, 2019) explains the concept of the “integrity of the site” at section 4.6.4 as the “coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated.”

We do not believe that the variation to the operational WDA permit will impact upon the Bristol Chanel Approaches SAC’s ecological structure, function and ecological processes across its whole area.

We were able to reach this conclusion due to the modelling results confirming that the polluting potential of the discharge would be too small to undermine the achievement of the conservation objectives. Site integrity cannot be considered to be adversely affected if the findings of an appropriate assessment demonstrate that the conservation objectives will not be undermined alone or in combination with other PPP.

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List of abbreviations

Term	Meaning
AA	Appropriate assessment
AAIR	Appropriate assessment information report
AFD	Acoustic fish deterrent
BOD	Biochemical oxygen demand
CA	Competent authority
CJEU	Court of Justice of the European Union
CCW	Countryside Council for Wales, NRW predecessor
cSAC	candidate Special Areas of Conservation
CWDA	Construction Water Discharge Activity
DCO	Development consent order
Defra	Department for Environment, Food and Rural Affairs
DIN	Dissolved inorganic nitrogen
EA	Environment Agency
EC	European Commission
EMS	European Marine Site
EQS	Environmental quality standard
EUNIS	European Nature Information Systems
FCS	Favourable conservation status
FRR system	Fish recovery and return system
HPB	Hinkley Point B
HPC	Hinkley Point C
HRA	Habitats Regulations assessment

HRAS	Habitat regulations assessment system
IFCA	Inshore Fisheries and Conservation Authorities
IPR	Iterative plan review
IROPI	Imperative reasons of overriding public interest
JNCC	Joint Nature Conservation Committee
kVA	Kilovolt-amperes
kWe	Kilowatt-electric
LSE	Likely significant effect
ML	Marine licence
MMO	Marine Management Organisation
MVA	Megavolt-amperes
MW	Megawatts
MWth	Megawatt thermal
NE	Natural England
NRW	Natural Resources Wales
PCBs	Polychlorinated biphenyls
PINS	Planning Inspectorate
PPP	Permissions, plans or projects
pSAC	possible Special Areas of Conservation
pSPA	potential Special Protection Area
Ramsar	Wetland of international importance
RSR	Radioactive substances regulations
SAC	Special Area for Conservation
SACO	Supplementary advice on conservation objectives
SCI	Sites of Community Importance

SNCB	Statutory nature conservation body
SNI	Sites of national importance
SPA	Special Protection Area for birds
TRO	Total residual oxidant
WDA	Water discharge activity
WFD	Water Framework Directive
ZOI	Zones of influence

Glossary

Term	Meaning
Activity	A generic title for the practices or operations which require to be permitted (unless exempted from the need for a permit).
Applicant	NNB Generation Company (SZC) Limited, the body applying for the WDA permit. Responsible for carrying out the necessary preparatory work in support of the application to enable the Environment Agency, as competent authority, to carry out its duties.
Biofouling	The accumulation of microorganisms, plants, algae or small animals where it is not wanted such as on marine infrastructure, where it can impede the structure's function.
Biota	In the context of our assessment, biota refers to animals (intact or otherwise) that have passed through the fish recovery and return System (ctenophores and jellyfish are excluded from our impingement mortality calculations).
Competent authority	Decision maker under the Habitats Regulations. For the WDA permit, it is the Environment Agency.
Environmental quality standard (EQS)	The concentration and a corresponding statistic (for example, mean or 95th percentile) below which a substance is not believed to be detrimental to aquatic life, based on the results of toxicity tests on organisms covering a range of levels within food chains. Each substance has its own EQS, which can differ depending on whether the receiving environment is fresh, transitional or coastal water.
European site	Sites such as SPAs and SACs which are protected under European and UK law. Ramsar sites are also included in line with government policy.
Eutrophication	The increase in primary productivity and subsequent impacts on an ecosystem that arise as a result of inputs of nutrients (which can be human) raising ambient nutrient concentrations.

Fish recovery and return system	A system by which impinged fish and invertebrates will be washed off the rotating screens that protect the cooling water system and returned to sea through dedicated outlets.
Functional linkage	Refers to the role or 'function' that land or seas beyond the boundary of a European site might fulfil in terms of ecologically supporting the site's features.
Habitats Regulations	The Conservation of Habitats and Species Regulations 2017 (as amended).
HRAS	The habitats regulations assessment system is a database used by the Environment Agency to generate HRA forms.
IFCA	Inshore Fisheries and Conservation Authorities.
Macroalgae	Macroalgae are part of the algae family and range completely in size and form. We commonly refer to them as seaweed.
Mixing zone	The mixing zone is the area around a discharge within which a quality standard is exceeded. The role of the regulator is to ensure that the size of the mixing zone is small enough so as to not impact on the function of the wider waterbody or habitat.
Moribund	Where an organism is at the point of death. In our mortality calculation, we have used the term moribund biota to mean biota passing through the FRR system that is dead and acts as a polluting matter.
Nutrient enrichment	The introduction of additional and/or new nutrients into a waterbody or other environment. This can cause disruption to the existing water quality regime and therefore impact on species and habitats.
Phytoplankton	Freely floating organisms which are able to photosynthesise; often minute organisms that move with water currents, for example, single-celled algae.
Plankton blooms	High abundances of particular plankton types as a result of physical conditions and elevated nutrient levels.

Qualifying or designated features	The features for which the European site is designated and to be protected and managed for conservation.
Sedimentation	The process by which suspended particles may settle out over time onto the bed of the waterbody.
Siltation	Physical damage caused by the deposit of suspended solids.
Source-receptor pathway	A framework for assessing the risk of a proposal on the environment. The source refers to the hazard – something that has the potential to cause harm. The receptor is something that could suffer harm from a hazard. The pathway is the way in which a hazard can come into contact with a receptor.
Special Area of Conservation	A protected area designated under the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales, or the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) for UK offshore areas.
Special Protection Area	Special Protection Areas are protected areas for birds classified under the Wildlife & Countryside Act 1981 (as amended), the Conservation (Natural Habitats, & c.) Regulations 2010 (as amended) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended).
Synergistic effect	The impact of the interaction of a number of effects is greater than the sum of the individual effects.
Tidal exchange	Need definition
Tidal excursion	The horizontal distance that a particle moves during one tidal cycle of ebb and flood.
Turbidity	The amount of cloudiness in the water. High turbidity would result in low visibility due to the presence of suspended material such as mud, silt and sand, bacteria and chemical precipitates. Visibility would be greater in low turbidity conditions.

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