The Sizewell C Project

5.10 Ch Shadow Habitat Regulations Assessment Third Addendum

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EXECUTIVE SUMMARY

Introduction

This Shadow Habitats Regulations Assessment Addendum ('Addendum') assesses the implications of a change to the Water Supply Strategy to propose new temporary infrastructure for the desalination and treatment of seawater to produce potable water suitable for construction-related activities until the Sizewell Transfer Main is delivered and operational ('Proposed Change 19').

Scoping of European sites

Proposed Change 19 does not alter the outcome of the scoping exercise as reported in the **Shadow HRA Report** (Doc Ref. 5.10 [**APP-145**]) (and updated in the first **Shadow HRA Addendum** (Doc Ref. 5.10) [**AS-178**] with respect to European sites with migratory fish qualifying features). Proposed Change 19 itself is not considered to have any pathway for effect on European sites with migratory fish qualifying features and, therefore, these sites do not require further assessment as part of this Shadow HRA Addendum.

Screening of potential effects

Proposed Change 19 does not alter the outcome of the LSE screening as reported in the **Shadow HRA Report** (Doc Ref. 5.10 [**APP-145**]).

The following screening categories are considered relevant to the assessment of potential effects:

- European sites with coastal, freshwater and terrestrial habitat qualifying features:
  - alteration of coastal processes / sediment transport.
  - water quality effects – marine environment.
- European sites with bird qualifying features:
  - alteration of coastal processes / sediment transport.
  - water quality effects – marine environment.
  - physical interaction between species and project infrastructure.
  - disturbance effects on species populations (for the Outer Thames Estuary SPA and Minsmere–Walberswick SPA and Ramsar site).
- European sites with marine mammal qualifying features:

- water quality effects – marine environment.
- disturbance effects on species populations.
- direct habitat loss and direct / indirect habitat fragmentation.
- physical interaction between species and project infrastructure.

Updates to baseline conditions

There are no updates to the description of baseline conditions relevant to the assessment of the Proposed Change 19. However, since the **Shadow HRA Report** [**APP-145**] and first **Shadow HRA Addendum** [**AS-178**] were prepared, the reference populations used in the marine mammal assessments have been updated, as outlined in **Section 6, Table 6.1**. Therefore, the marine mammal assessments reported in this Addendum have been based on the updated reference populations, as well as the previous reference populations to allow for a comparison of the potential effects of the Proposed Change 19 based on the previous and updated marine mammal reference populations.

Information for appropriate assessment

a) Coastal, freshwater and terrestrial habitats

Proposed Change 19 has the potential to cause different effects on coastal processes to those described in the **Shadow HRA Report** (Doc Ref. 5.10 [**APP-145**]) and first **Shadow HRA Addendum** [**AS-178**]. The relevant effect pathways are assessed for the following European sites:

- Minsmere to Walberswick Heaths and Marshes SAC.
- Minsmere-Walberswick Ramsar site.

Dredging and dredge spoil disposal, drilling for connection to headworks, construction platform operations and the physical presence of the intake and outfall heads has been assessed with regard to 'alteration of coastal processes / sediment transport' and 'water quality effects – marine environment' pathways. It is concluded that there is no potential for anything other than a very localised effect, and the conclusions of the **Shadow HRA Report** (Doc Ref. 5.10 [**APP-145**]) and first **Shadow HRA Addendum** [AS-178] are unaltered as a result of Proposed Change 19, and no adverse effect on integrity is concluded.

b) Birds

In relation to the qualifying features of SPAs (and Ramsar sites in terms of ornithology), Proposed Change 19 is considered to have the potential to cause different effects to

those described in the **Shadow HRA Report** (Doc Ref. 5.10 [**APP-145**]) and first **Shadow HRA Addendum** [**AS-178**] for the following pathways:

- Alteration of coastal processes and sediment transport.
- Water quality effects – marine environment.
- Disturbance effects on species populations.
- Physical interaction between species and project infrastructure.

In the context of Proposed Change 19, these effect-pathways are identified as being relevant to the:

- Alde-Ore Estuary SPA and Ramsar site.
- The Minsmere-Walberswick SPA and Ramsar site.
- The Outer Thames Estuary SPA.

Based upon the assessment that is undertaken, the potential effects resulting from Proposed Change 19 are predicted to be of a small scale and, frequently, of short duration. As such, the Proposed Change 19 would not result in an adverse effect on integrity for any of the above designated sites and do not alter the conclusions of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-178]. All potential effects are within the worst-case previously assessed and would not result in changes to the existing in-combination assessments.

c) Marine mammals

i. Updates to baseline conditions

The updated reference populations and seal counts do not alter do not alter the conclusions of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-178] with respect to European sites with grey seal, harbour porpoise or harbour seal qualifying interest features.

ii. Assessment of Proposed Change 19

The most relevant potential effect associated with Proposed Change 19 is effect on water quality and increased underwater noise during dredging. The assessment has been updated to reflect the potential effects of Proposed Change 19.

The assessment concludes that the findings of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-178] are unchanged with respect to grey seal (Humber Estuary SAC), harbour porpoise (Southern North Sea SAC) and harbour seal (The Wash and North Norfolk Coast SAC); all potential effects

are within the worst-case previously assessed. Therefore, there would be no adverse effect on the integrity of these SACs.

1 INTRODUCTION

1.1 Background

1.1.1 NNB Generation Company (SZC) Limited (SZC Co.) submitted an application for a Development Consent Order (DCO) to the Planning Inspectorate under the Planning Act 2008 for the Sizewell C Project (referred to as the 'Application') in May 2020. The Application was accepted for examination in June 2020.

1.1.2 In April 2021, 15 changes to the Application ('Proposed Changes 1 to 15') were accepted for Examination by the ExA. A **Shadow Habitats Regulations Assessment (HRA) Addendum** (Doc Ref. 5.10) [AS-173 to AS-178] presented an assessment of any new or different effects that were likely to result from: (i) updated baseline surveys undertaken in late 2019-2020 for wintering waterbirds, breeding waterbirds, nightjar, marsh harrier and terns, (ii) additional Information on fish assessments, comprising revised predictions of fish entrapment, further assessment of potential effects on certain fish stocks and European populations estimates of twaite shad, (iii) additional noise modelling outputs, (iv) assessment of effects of the proposed changes to the Application and (v) further analysis of inter-pathway effects. The opportunity was also taken to provide a Site Integrity Plan for the Southern North Sea (SNS) Special Area of Conservation (SAC).

1.1.3 A second **Shadow HRA Addendum** [REP2-032] was submitted in June 2021. That Addendum had a single purpose, namely to report an update to the calculations of potential change in recreational use of European sites by displaced visitors and construction workers and to assess the implications of this change on the assessment of recreational displacement.

1.1.4 As a result of the ongoing engagement between SZC Co. and stakeholders, including as part of the process of agreeing common ground and ongoing design development, SZC Co. subsequently identified three further proposed changes ('Proposed Changes 16 to 18'). These changes were accepted for examination by the Examining Authority in August 2021. The change request was not accompanied by a further Shadow HRA Addendum, with the covering letter [REP5-002] confirming that Proposed Changes 16 to 18 did not result in any changes to the Shadow HRA.

1.1.5 SZC Co. now wishes to make one further change to the application in response to recent engagement with Northumbrian Water Limited in relation to the supply of potable water (see **Section 2**). This is referred to a 'Proposed Change 19' throughout this Addendum.

1.2 Purpose of the Shadow HRA Addendum

1.2.1 A **Shadow HRA Report** (Doc Ref. 5.10) [APP-145 to APP-152] was submitted as part of the Application. It comprised four volumes, as follows:

- **Shadow HRA Report, Volume 1: Stages 1 and 2 - Screening and Appropriate Assessment** (Doc Ref. 5.10) [APP-145 to APP-149].
- **Shadow HRA Report, Volume 2: Stage 3 – Assessment of Alternative Solutions** (Doc Ref. 5.10) [APP-150].
- **Shadow HRA Report, Volume 3: Stage 4 - Imperative Reasons of Overriding Public Interest (IROPI)** (Doc Ref. 5.10) [APP-151].
- **Shadow HRA Report, Volume 4: Compensatory Measures** (Doc Ref. 5.10) [APP-152].

1.2.2 As noted in Section 1, a **Shadow HRA Addendum** (Doc Ref. 5.10) [AS-173 to AS-178] assessed the effects of Proposed Changes 1 to 15 to the Application (amongst other matters) and was accepted by the ExA for examination in April 2021.

1.2.3 This report is a further Addendum to the **Shadow HRA Report**. The purpose of this **Shadow HRA Addendum** (the 'third Shadow HRA Addendum') is to present an assessment of Proposed Change 19.

2 SUMMARY OF PROPOSED CHANGE 19

2.1.1 Proposed Change 19 is described in **Chapter 3** of the **Fourth ES Addendum** (Doc Ref. 6.18).

2.1.2 In summary, Proposed Change 19 comprises new temporary infrastructure for the desalination and treatment of seawater to produce potable water suitable for construction-related activities until the Sizewell Transfer Main is delivered and operational.

2.1.3 The desalination process comprises the following core components:

- Onshore desalination equipment;
- Seawater intake pipe and associated headworks; and
- Brine water outfall pipe and associated diffusers.

2.1.4 The implications of Proposed Change 19 on the conclusions of the Shadow HRA are assessed in this third Shadow HRA Addendum.

3 THE HABITATS REGULATIONS ASSESSMENT PROCESS

3.1.1 Since the submission of the Application there have been no procedural changes to the HRA process (i.e. the staged approach to the likely significant effect (LSE) screening, appropriate assessment, etc.) reported in the **Shadow HRA Report** (Doc Ref. 5.10 [**APP-145**]).

4 SCOPING OF EUROPEAN SITES

4.1.1 The scoping exercise, which identifies the European sites and the qualifying interest features to be taken forward into the LSE screening stage, is reported in **Section 4** of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]).

4.1.2 Proposed Change 19 does not create any pathways to additional European sites and, therefore, does not alter the outcome of the scoping exercise as reported in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145], and updated in the first **Shadow HRA Addendum** (Doc Ref. 5.10) [AS-178 to AS-178] with respect to European sites with migratory fish qualifying features.

4.1.3 It is concluded that the following European sites (and qualifying interest features) are relevant to the scope of the assessment of the effects of Proposed Change 19.

a) European sites with coastal, freshwater and terrestrial habitat qualifying features

- Minsmere to Walberswick Heaths and Marshes Special Area of Conservation (SAC):
- Annual vegetation of drift lines.
- Perennial vegetation of stony banks.
- Minsmere-Walberswick Ramsar site:
- Ramsar criterion 1 - mosaic of marine, freshwater, marshland and associated habitats.
- Ramsar criterion 2 - supports nine nationally scarce plants and at least 26 red data book invertebrates; an important assemblage of rare breeding birds associated with marshland and reedbeds.

b) European sites with bird qualifying features

- Alde-Ore Estuary Special Protection Area (SPA):
- Little tern (breeding).
- Sandwich tern (breeding).
- Lesser black-backed gull (breeding).
- Alde-Ore Estuary Ramsar site:
- Lesser black-backed gull (breeding).
- Minsmere–Walberswick SPA:
- Avocet (breeding).
- Bittern (breeding).
- Little tern (breeding).
- Marsh harrier (breeding).
- Nightjar (breeding).
- Shoveler (breeding).
- Teal (breeding).
- Gadwall (breeding).
- Gadwall (non-breeding).
- Hen harrier (non-breeding).
- Shoveler (non-breeding).
- White fronted goose (non-breeding).
- Minsmere-Walberswick Ramsar site:
- Important assemblage of rare breeding birds associated with marshland and reedbeds
- Outer Thames Estuary SPA:

- Little tern (breeding).
- Common tern (breeding).
- Red-throated diver (non-breeding).

c) European sites with marine mammal qualifying features

- Humber Estuary SAC:
- Grey seal.
- Southern North Sea SAC:
- Harbour porpoise.
- The Wash and North Norfolk Coast SAC:
- Harbour seal.

d) European sites with migratory fish qualifying features

4.1.4 The scoping exercise for European sites with migratory fish qualifying features reported in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145], was updated in the first **Shadow HRA Addendum** (Doc Ref. 5.10) [AS-178]. The relevant pathway for effect on migratory fish is 'physical interaction between species and project infrastructure'.

4.1.5 The seawater intake for the desalination plant would consist of a Passive Wedge-Wire Cylinder (PWWC) screen with a mesh size of approximately 2mm. The 0 group (fish in the first year of their life) of twaite shad and allis shad are not at risk of entrainment because that part of their lifecycle is not present in the coastal waters off Sizewell.

4.1.6 River lamprey does occur in the coastal waters off Sizewell; however, the 2mm mesh would preclude even the smallest individuals being entrained.

4.1.7 Given the above, there is no pathway for effect on European sites with migratory fish qualifying features due to Proposed Change 19, and the conclusions of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145], as updated in the first **Shadow HRA Addendum** (Doc Ref. 5.10) [AS-178], are unchanged with regard to the effect of the Sizewell C Project alone and in-combination with other plans and projects. European sites with migratory fish qualifying features are scoped out of this third Shadow HRA Addendum.

5 SCREENING OF POTENTIAL EFFECTS

5.1 Introduction

5.1.1 The LSE screening exercise is reported in **Section 5** of the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145] and was updated (with respect to European sites with migratory fish qualifying features) in the first **Shadow HRA Addendum** (Doc Ref. 5.10) [AS-178].

5.1.2 Proposed Change 19 does not result in a new pathway for potential effect on European sites not already assessed and, therefore, Proposed Change 19 does not alter the outcome of the LSE screening exercise as reported in the **Shadow HRA Report** (Doc Ref. 5.10) [APP-145], as updated in the first **Shadow HRA Addendum** (Doc Ref. 5.10) [AS-178].

5.1.3 **Section 5.2** summarises European sites (and relevant qualifying interest features) potentially affected by Proposed Change 19 and the relevant screening categories.

5.2 Relevant screening categories

a) European sites with coastal, freshwater and terrestrial habitat qualifying features

5.2.1 The following screening categories represent potential effect pathways for the relevant qualifying features of the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar site:

- alteration of coastal processes / sediment transport.
- water quality effects – marine environment.

b) European sites with bird qualifying features

5.2.2 The following screening categories represent potential effect pathways for the breeding tern and gull populations of the Alde-Ore Estuary SPA, Alde-Ore Estuary Ramsar site, Minsmere–Walberswick SPA, Minsmere-Walberswick Ramsar site:

- alteration of coastal processes / sediment transport.
- water quality effects – marine environment.
- physical interaction between species and project infrastructure.

5.2.3 The 'water quality effects – marine environment', 'physical interaction between species and project infrastructure' and 'disturbance effects on species populations' screening categories are relevant to all of the qualifying features of the Outer Thames Estuary SPA.

5.2.4 In addition to the above, 'disturbance effects on species populations' is a relevant pathway for the other qualifying features of the Minsmere–Walberswick SPA and Ramsar site.

c) European sites with marine mammal qualifying features

5.2.5 The following screening categories represent potential effect pathways for the marine mammal populations of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC:

- water quality effects – marine environment.
- disturbance effects on species populations.
- direct habitat loss and direct / indirect habitat fragmentation.
- physical interaction between species and project infrastructure.

5.3 Screening for likely significant effect

a) Summary of potential effects

5.3.1 The desalination plant would be installed, used and decommissioned within the construction phase of Sizewell C. Construction of the desalination plant would take approximately 4-6 months and can only commence once the main platform, where it would initially be located, has been suitably prepared.

5.3.2 Once constructed, the modular desalination plant would initially be capable of producing up to approximately 2,600m^3 of potable water per day. In the event that the water transfer main is not complete by the fourth year of construction, an additional module would be added to the plant to create the ability to produce up to approximately 4,000m^3 of potable water per day. This provides a realistic worst-case for assessment purposes.

5.3.3 The plant would initially be located in the main platform area. Once construction activity in the main platform area reaches a point where the desalination plant becomes a physical constraint, it would be relocated to the temporary construction area (TCA) if the Sizewell transfer main is not already delivered by that time.

5.3.4 The potential effects, as fully assessed in the **Fourth ES Addendum** (Doc Ref. 6.18), are summarised below.

i. Coastal geomorphology and hydrodynamics

5.3.5 The elements of Proposed Change 19 of relevance to the assessment of coastal geomorphology and hydrodynamics include the installation and presence/usage and removal of intake and outfall heads for the desalination plant in the nearshore zone, seaward of the outer longshore bar crest. These elements comprise dredging, disposal of dredged material, drilling, presence of construction plant and presence of the heads and are assessed in the **Fourth ES Addendum** (Doc Ref. 6.18) for the following pressures:

- Changes to tidal flow.
- Changes to wave propagation shoreward.
- Changes in suspended sediments.
- Sedimentation rate changes.
- Sediment bed change.

5.3.6 The **Fourth ES Addendum** (Doc Ref. 6.18) concludes that all potential impacts would be of negligible significance, and therefore there is minimal potential for effect on European sites. However, it is concluded that likely significant effect cannot be excluded and this pathway is therefore screened into the appropriate assessment for the European sites listed in Section 5.2 a) and b).

ii. Habitat change - removal of substratum

5.3.7 Localised dredging would be necessary in the immediate area surrounding the headwork and would involve removal of substrate.

5.3.8 Dredging volumes are expected to be the same as for the fish recovery and return (FRR) assessment, which already form part of the proposals, with a maximum of an additional 0.26ha (0.0026km^2) of seabed impacted by dredging for the desalination plant headworks.

5.3.9 For the purposes of the assessments, it has been assumed that dredging prior to the installation for the desalination intake and outfalls would be undertaken employing the same method, volume and depth as the other inshore headworks (i.e. the FRR outfalls and the combined drainage outfall (CDO)). This is likely to be a conservative assumption as the diameter of

the desalination plant intake and outfall pipelines are smaller than the FRR pipeline.

5.3.10 The individual dredge events would be short in duration and at individual scales with limited, localised impacts, and would not interact.

5.3.11 Removal of substratum causing displacement of fish receptors to alterative areas would occur over a very limited area and effect a very small proportion of fish within the Greater Sizewell Bay (GSB). Substrate removal is predicted to have a negligible effect on the distribution of fish within the GSB, with no significant changes in the availability of fish as prey items for designated features.

5.3.12 Given the very small extent of this habitat change, it is considered that there is no pathway to effect on SPA bird populations and, hence, **no likely significant effect** on these populations. Therefore, the effect is not assessed further for SPA or Ramsar site bird populations in this third **Shadow HRA Addendum**.

iii. Changes in suspended sediment concentrations

Increase in suspended sediment concentrations due to disturbance of the seabed

5.3.13 Additional dredging prior to the installation of the seawater intake and outfall headworks and possible bentonite frac-out from Horizontal Directional Drilling (HDD) would cause temporary increases in suspended sediment concentration (SSC).

5.3.14 The changes in suspended sediment as a result of the construction of the desalination infrastructure is assumed to be the same as those for the FRR and CDO head. Empirical modelling in **Volume 2, Chapter 22, Appendix 22J** [APP-327] provided evidence for SSC at receptor-specific depth profiles and was used to inform impact assessments. Dredging volumes and release locations are anticipated to be comparable with those for the FRR and CDO head assessments made within **Volume 2, Chapter 22** of the **ES** (Doc Ref. 6.3) [AS-035].

5.3.15 While increases in SSC could be relatively large compared to baseline conditions, the transient nature of the plumes and their intermediate spatial footprint, would result in short-term, temporary, localised effects and therefore not significant relative to natural background variation in SSC.

5.3.16 However, the potential effects of increased SSC have been screened in for further assessment in this third **Shadow HRA Addendum**.

Increase in suspended sediment concentrations due to possible bentonite frac-out

5.3.17 The drilling fluid predominantly used in HDD is a mix of water and a naturally occurring swelling clay, bentonite. Bentonite has a neutral pH level (8-9) and grain size less than 60 microns. Bentonite is on The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) commission PLONOR (Pose Little or No Risk to the Environment) list.

5.3.18 If bentonite was released into the marine environment following a frac-out, depending upon flow conditions, clays could remain in suspension for a considerable distance. This increase in the suspended sediment load could potentially result in an increase in the turbidity of the water column.

5.3.19 The impact of increased SSC resulting from possible bentonite frac-out from HDD is predicted to have a short-lived effect on turbidity. Any effects are not predicted to be significant relative to natural background variation in SSC. Given this nature of the possible effect of a bentonite frac-out, and the fact that bentonite is on the OSPAR PLONOR list, **no likely significant effect** is concluded and this has not been assessed further in this third **Shadow HRA Addendum**.

iv. Sedimentation rate changes

5.3.20 Additional dredging would cause deposition of suspended sediments which can lead to smothering.

5.3.21 Sediment suspended by dredging and dredge disposal for the installation of the desalination plant would subsequently be deposited onto the seabed. It is predicted that all suspended sediment would be deposited within hours of dredging and then dispersed by natural resuspension.

5.3.22 The sedimentation for the desalination infrastructure is anticipated to be comparable to the FRR and CDO head assessments made within **Volume 2, Chapter 22** of the **ES** (Doc Ref. 6.3) [AS-035] and empirically modelled in **Volume 2, Chapter 22, Appendix 22J** [APP-327].

5.3.23 As no area would be exposed to more than 'light' deposition, and deposited sediments would be rapidly dispersed, the potential for any effects are very low.

5.3.24 Changes in sedimentation rates associated with dredging installation of desalinisation plant is not predicted to affect the distribution of fish within GSB. No indirect food web effects or changes in the availability of fish as prey items for designated features or as fisheries resources are expected. Fish are not sensitive to displacement resulting from sedimentation rate

changes. Effects from dredging activities are predicted to be negligible and have **no likely significant effect**. Therefore, this has not been assessed further in this third **Shadow HRA Addendum**.

5.3.25 Possible bentonite frac-out from HDD for the intake and outfall could also result in sedimentation rate changes. However, the amount of bentonite that would be released in the event of a bentonite frac-out is likely to be minimal as a bentonite recovery system would be used during drilling to minimise emissions.

5.3.26 Therefore, **no likely significant effect** is concluded and increased SSC from bentonite frac-out has not been assessed further in this third **Shadow HRA Addendum**.

v. Underwater noise - dredging

5.3.27 Additional dredging for the intake and outfall (diffuser) headworks would generate underwater noise.

5.3.28 Underwater noise modelling for dredging activities associated with the FRR and CDO heads assumed dredging would last for 9.5 hours and applied precautionary source levels from a large trailing suction hopper dredger (**Volume 2, Appendix 22L** of the **ES** (Doc Ref. 6.3) [AS-329]. Modelled ranges are provided in the **Volume 2, Chapter 22, Table 22.90** of the **ES** (Doc Ref. 6.3) [AS-035].

5.3.29 The potential effects of underwater noise from dredging activities for the desalination plant intakes and outfall heads would be within the envelope of those assessed in the **Shadow HRA Report** [APP-145] and first **Shadow HRA Addendum** [AS-178].

5.3.30 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), noise levels arising from dredging activities are predicted to be too low to generate instantaneous auditory effect zones for fish. Cumulative (24-hour) noise exposure modelling for the most sensitive species (such as herring and sprat) indicates the potential for mortality/potential mortality is only within 25m (0.25ha / 0.0025km^2). Recoverable injury is limited to sensitive fish remaining within 100m (3ha / 0.03km^2) for the duration of the dredging activities.

5.3.31 The maximum potential for temporary change in hearing sensitivity (Temporary Threshold Shift (TTS)) extends to a range of 1.1km (173ha / 1.73km^2). However, high recoverability from TTS is anticipated.

5.3.32 Behavioural effects in fish from dredging are predicted to have maximum impact ranges of approximately 2.3km (an area of approximately 670ha / 6.7km^2) for sensitive fish species with swim bladder or other air cavities to

aid hearing such as herring and sprat (category 1) and species with a swim bladder that does not aid hearing such as European sea bass and eel (category 2) and approximately 800m (approximately 120ha / 1.2km^2) for fish without a swim bladder (category 3).

5.3.33 Dredging for the installation of the desalination headworks would be short-term discrete events. Where fish have experienced minor disturbances and moved away from dredging, it is anticipated they would return to the area in a matter of hours to days. Any effects would not be significant at the sea area and regional stock/population levels.

5.3.34 The indirect effects of localised displacement of fish as prey species for bird receptors are assessed in an EIA context in **Volume 2, Chapter 14, Sections 14.12c)i** and **14.12c)ii** of the **ES** (Doc Ref. 6.3) [APP-224]. That assessment is unchanged by the additional dredging associated with Proposed Change 19 as the dredging works will be short in duration and not overlap with dredging for other installations. However, the potential effect of underwater noise generated during dredging as part of Proposed Change 19 is assessed in this third Shadow HRA Addendum.

vi. Underwater noise - removal

5.3.35 Following use of the desalination plant in the construction phase, the headworks would be removed. During removal of the intake heads connecting pipework would need to be cut. As a worst case for underwater noise, water jet cutting is assessed.

5.3.36 The effects of water jet cutting were assessed for the decommissioning of the temporary Beach Landing Facility (BLF) based on worst-case assumptions and at the deepest point for greatest sound propagation (**Underwater Noise Report** (Doc Ref 9.58) [REP5-124]).

5.3.37 Noise levels would be too low to generate instantaneous effects. Cumulative predicted effect ranges for mortality and recoverable injury were within 25m of the sound source. TTS effects of the water jet cutting decommissioning method were predicted to be less than for dredging at 600m (92ha / 0.92km^2) applying the assumption of no fleeing. The impacts associated with removal of the heads are less than those assessed for installation. However, the potential effect of underwater noise generated during removal of the headworks is assessed in this third Shadow HRA Addendum.

vii. Visual disturbance

5.3.38 Additional introduction of artificial light can potentially cause disturbance and displacement.

5.3.39 Construction of the desalination plant would take approximately 4-6 months, with the potential for an additional module to be added in the fourth year of construction of the Sizewell C Project. Artificial lighting in the marine environment would be a likely requirement during dredging and installation works for the desalination intake and outfall.

5.3.40 The potential effects of any visual disturbance is anticipated to be the same as for the FFR outfall installation. Localised dredging is assumed to be necessary only in the immediate area surrounding the intake headwork and brine water outfall diffusers. Therefore, any artificial light introduced would be short-term and temporary.

5.3.41 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), marine mammals are not sensitive to visual disturbance from artificial light (see paragraphs 22.9.84-87 of **Volume 2, Chapter 22** of the **ES** (Doc Ref. 6.3) [AS-035]). Therefore, **no likely significant effect** is concluded, and this has not been assessed further in this third **Shadow HRA Addendum** for marine mammals.

viii. Physical change to another seabed type

5.3.42 The additional seabed infrastructure has the potential to result in habitat change.

5.3.43 The installation of the desalination intake and outfall heads and any associated scour protection would result in a change in seabed type from soft sediment (fine to medium sand) to an artificial hard surface.

5.3.44 The potential effects are anticipated to be the same as the assessment for the FFR outfall heads. However, the spatial scale of effect would be less, as the seawater outfall headworks would be decommissioned and removed once the transfer main is fully available. The buried intake pipeline would be grouted (or similar), capped and would remain *in situ*.

5.3.45 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), any potential effects on benthic invertebrates are predicted to be negligible and there is no pathway for effect on qualifying features of European sites. Therefore, there is **no likely significant effect** is concluded, and this has not been assessed further in this **Shadow HRA Addendum**.

ix. Spread of non-indigenous species

5.3.46 Additional introduction of hard substrate in a primarily soft sediment environment has the potential to facilitate the spread of invasive non-indigenous species (INNS) that prefer hard substrates.

5.3.47 The potential effects are anticipated to be the same as the assessment for the FFR outfall heads. However, the spatial scale of effect would be less, as the seawater outfall headworks would be decommissioned and removed once the transfer main is fully available. The buried intake pipeline would be grouted (or similar), capped and would remain *in situ*..

5.3.48 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), the potential spread of INNS resulting from the installation of desalination intake and outfall heads and any associated scour protection is predicted to have a negligible effect. Therefore, there is **no likely significant effect** concluded, and this has not been assessed further in this **Shadow HRA Addendum**.

x. Entrainment: desalination water abstraction

5.3.49 There is the potential that phytoplankton, zooplankton, ichthyoplankton and fish could be entrained during seawater abstraction into the desalination plant.

5.3.50 Up to a maximum of 10Ml per day of seawater will be abstracted from the marine environment and treated to produce potable water for construction activities. This is equivalent to less than 0.09% of the proposed cooling water abstraction once the Sizewell C power station is operational.

5.3.51 The seawater intake would consist of a PWWC screen with a mesh size of approximately 2mm. The headworks would be positioned to reduce the tidal forcing against the screens and minimise approach velocities where possible.

5.3.52 The volume of water abstracted in the open coastal system is very small relative to the tidal exchange. Assuming a conservative 10% daily tidal exchange rate, the maximum abstraction of 10Ml per day equates to approximately 0.03% of the tidal exchange in the Greater Sizewell Bay (see **Appendix 22H** of **Volume 2, Chapter 22** of the **ES** [APP-325]).

5.3.53 There will be no temporal overlap of the desalination abstraction with the cooling water abstraction during operation.

5.3.54 Any potential effects of any entrainment of phytoplankton, zooplankton, ichthyoplankton and fish for the desalination plant during construction would be less than those assessed for cooling water abstraction during operation.

5.3.55 Entrainment is predicted to have negligible effects on fish populations. Effects are not significant relative to high levels of natural variability.

5.3.56 An assessment of localised depletion on larval and juvenile fish at the scale of the GSB has been provided assessing the combine abstraction of SZB

and SZC (**Volume 3, Appendix 2.17A** of the **ES Addendum** (Doc. Ref 6.14) [REP6-016]) to assess the potential for food-web effects mediated through local reductions in prey availability.

5.3.57 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), the very small abstraction rates relative to tidal exchange in the open coastal environment would result in negligible losses in the availability of prey resources and the effects of localised depletion would not be significant.

5.3.58 Because the mesh for the desalination abstraction is at the headworks, biota which are not entrained are not drawn into the system at all (i.e. there is no impingement), and this does not, therefore, require assessment in this Shadow HRA Addendum.

xi. Increases in salinity

5.3.59 Local changes in salinity associated with the brine discharge from the desalination outfall have the potential to affect the physiology and behaviour (e.g. avoidance) of marine species.

5.3.60 During use the desalination plant would abstract seawater and potable water would be produced using Sea Water Reverse Osmosis (SWRO). Desalination plants typically convert 40% of the abstracted water into freshwater. Discharges would be released as a controlled brine. The high salinity discharge would be denser than the seawater and would tend to sink to the seabed. The use of a diffuser head would facilitate rapid mixing and direct the discharge off the seabed.

5.3.61 As detailed in the **Fourth ES Addendum** (Doc Ref. 6.18), the desalination concentrate discharge would be highly saline at around 20 practical salinity units (PSU) above the background salinity. However, the use of a diffuser head would facilitate more rapid mixing and the discharge plume modelling results indicate that excess salinity would fall to within 1 PSU above background within approximately 6 to 10m of the discharge.

5.3.62 Salinity at Sizewell follows an annual trend with lowest values observed in Winter months. The mean annual salinity is 33.3 PSU whilst the 5th percentile Winter salinity is 31.7 PSU (see **Section 21.4B.b** of **Volume 2**, **Chapter 21** of the **ES** [APP-324]).

5.3.63 There will be a very small area which is exposed to salinities greater than 1 PSU above ambient.

5.3.64 Changes in salinity associated with the desalination plant are not predicted to affect the distribution of fish within the GSB. No indirect food web effects or changes in the availability of fish as prey items for designated features are expected. Fish are not sensitive to displacement resulting from

localised increases in salinity. As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), effects from saline discharge are predicted to be negligible and not significant.

5.3.65 The increases in salinity in the discharges from the desalination plant during construction will not occur at the same time or overlap with discharges during operation.

SPA birds

5.3.66 Increases in salinity would extend over a very small area (up to 10m) representing a very small proportion of the predicted foraging ranges for any of the SPA populations of marine birds which extend over areas of several km^2 to several hundred km^2 (see **sections 6.3 a)**, **f)** and **h)** of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145])). Furthermore, as described above, fish are not sensitive to displacement resulting from localised increases in salinity and no indirect food web effects or changes in the availability of fish as prey items for designated features are expected. On this basis, there is **no likely significant effect** on SPA bird populations, and this has not been assessed further in this third **Shadow HRA Addendum**.

Marine Mammals

5.3.67 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), marine mammals are not sensitive to changes or increase in salinity. Any increases in salinity would be over a very small area (up to 10m).

5.3.68 The impact of increases in salinity resulting from the saline discharge associated with the operation of the desalination plant is predicted to have a negligible effect on marine mammals and their prey species. Therefore, there is **no likely significant effect**, and this has not been assessed further in this third **Shadow HRA Addendum**.

xii. Heavy metal contamination

5.3.69 Discharges from the desalination plant would be released as a controlled brine. Approximately 90-99% of the loading of most of the substances in the 40% of water retained for potable supply would be discharged back to the sea as a brine concentrate. The heavy metals in the brine would be 1.6 times more concentrated than the metals and trace elements in the discharge relative to those in seawater. The discharge would be at ambient temperature.

5.3.70 As detailed in **Appendix 3.A** of the **Fourth ES Addendum** (Doc Ref. 6.18), three metals; zinc, chromium and lead are predicted to be in excess of EQS or applied thresholds as a result of the desalination discharge.

5.3.71 Notably, background levels of lead and zinc measured in the GSB are above their respective EQS levels and therefore an assessment is made relative to background levels.

5.3.72 Modelling of the worst-case discharge plume, presented in **Appendix 3.A** of the **Fourth ES Addendum** (Doc Ref. 6.18), using the maximum 10Ml per day (6Ml per day discharge) scenario, indicates the maximum area, calculated based on the tidal ellipse, above EQS (or detectable above background concentrations) for zinc is 0.03ha (0.0003km^2), for chromium is 0.08ha (0.0008km^2), and for lead is 0.02ha (0.0002km^2). Based on the assumption that the maximum plume extent is 38.5m (for chromium) represents the radius of a circle around the discharge point, the maximum bounding area affected by substances in the desalination discharge would be precautionarily estimated as <0.5ha (<0.005km^2). The spatial area affected by the elevated concentration would persist for the duration of the desalination plant use.

5.3.73 The duration of the discharge is potentially several years, however, the spatial area of exposure is very small.

5.3.74 The impact of chromium, lead and zinc exposure resulting from construction discharges, is predicted to have a negligible effect on plankton, benthic invertebrates, marine fish. Any potential effects on fish are not significant at the sea area and regional stock/population levels.

5.3.75 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), any displacement behaviour due to discharges of heavy metals is predicted to be highly localised and exposure would represent a negligibly small proportion of fish in the GSB. Therefore, no significant changes in the availability as prey items for designated features are predicted.

5.3.76 The localised increases in heavy metal concentrations in the discharges from the desalination plant during construction will not occur at the same time or overlap with discharges during operation of the power station.

SPA birds

5.3.77 These discharges will encompass a very limited spatial extent, representing a very small proportion of the predicted foraging ranges for any of the SPA populations of marine birds which extend over areas of several km^2 to several hundred km^2 (see **sections 6.3 a)**, **f)** and **h)** of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145])). Therefore, there would be little chance of direct exposure to these heavy metals. Furthermore, as described

above, effects on fish are predicted to be negligible with any displacement behaviour being highly localised, so that there is no potential for indirect effects on SPA birds via effects on prey species. On this basis, there is **no likely significant effect** on SPA bird populations, and this has not been assessed further in this third **Shadow HRA Addendum.**

xiii. Nutrient enrichment

5.3.78 Nutrient discharges have the potential to enhance phytoplankton biomass particularly if they occur during periods of nutrient limitation which can have indirect food web effects on higher trophic levels.

5.3.79 However, nutrient additions stimulating primary production are only relevant if effects on primary producers are predicted to be discernible about natural variability. Given the negligible effects on phytoplankton productivity described in **Appendix 3.B** of the **Fourth ES Addendum** (Doc Ref. 6.18), no food web effects are predicted. Therefore, **no likely significant effects** and has not been assessed further in this third **Shadow HRA Addendum**.

xiv. Abrasion / physical disturbance

5.3.80 Activities associated with removal of the intakes (e.g. the use of jack-up barges and anchoring) have the potential to cause localised surface and sub-surface abrasion from the physical presence of the jack-up legs and anchors on the seabed.

5.3.81 Any potential effects would have a short duration and limited spatial extent relative to the available soft sediment within the GSB. As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), a rapid recovery would be expected to any benthic invertebrates.

5.3.82 The potential effects are predicted to be negligible and not significant. Therefore, **no likely significant effects** and has not been assessed further in this third **Shadow HRA Addendum**.

xv. Inter-pathway effects

5.3.83 The potential effects identified and assessed for Proposed Change 19 have the potential to interact with each other (inter-pathway effects) and/or other potential effects from the wider Sizewell C Project during the construction period, generating a different effect compared to that predicted for each assessed pathway for Proposed Change 19 when considered in isolation.

5.3.84 The potential for any interactive effects between pathways and with the wider Sizewell C Project as a result of Proposed Change 19 has been assessed and compared to the assessments reported in the **Shadow HRA**

Report (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-173] (including Appendix 1A [AS-174]).

5.3.85 The assessments are based on worst-case effects, and therefore the assessments are considered conservative and robust.

xvi. In-combination effects with other plans and projects

5.3.86 The potential for any in-combination effects with other plans and projects as a result of Proposed Change 19 has been assessed in the context of the assessments in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-173] to determine if the inclusion of Proposed Change 19 alters any of the conclusions of the previous assessments.

5.3.87 The assessments are based on worst-case effects, and therefore the assessments are considered conservative and robust.

b) European sites with coastal, freshwater and terrestrial habitat qualifying features

5.3.88 Based on the considerations in **section 5.3 a),** the following potential effects are screened in for the annual vegetation of drift lines and perennial vegetation of stony banks qualifying features of the Minsmere to Walberswick Heaths and Marshes SAC and the habitat criteria of the Minsmere-Walberswick Ramsar site:

- Alteration of coastal processes / sediment transport: due to potential changes to tidal flows, wave propagation, SSC, sedimentation rate and sediment bed change;
- Water quality effects – marine environment: due to potential effects of increases in SSC;
- Inter-pathways effects; and
- In-combination effects with other plans and projects.

c) European sites with bird qualifying features

5.3.89 Based on the considerations in **section 5.3 a)**, the following potential effects are screened in for each of the relevant European sites and associated bird qualifying features.

i. For the Alde-Ore Estuary SPA (and Ramsar site):

Breeding little tern, Sandwich tern and lesser black-backed gull

- Alteration of coastal processes / sediment transport.
- Water quality effects – marine environment: due to potential effects of increases in SSC.
- Disturbance effects on species populations: due to potential effects of; (i) underwater noise from dredging and removal of headworks; (ii) artificial lighting during construction of the desalination plant; (iii) airborne noise during construction of the desalination plant; and (iv) anthropogenic activity (leading to visual disturbance) during construction of the desalination plant.
- Physical interaction between species and project infrastructure: due to potential effects on prey abundance as a result of entrainment.
- Inter-pathways effects.
- In-combination effects with other plans and projects.

ii. For the Minsmere-Walberswick SPA (and Ramsar site):

Breeding little tern

- Alteration of coastal processes / sediment transport.
- Water quality effects – marine environment: due to potential effects of increases in SSC.
- Disturbance effects on species populations: due to potential effects of (i) underwater noise from dredging and removal of headworks; (ii) artificial lighting during construction of the desalination plant; (iii) airborne noise during construction of the desalination plant; and (iv) anthropogenic activity (leading to visual disturbance) during construction of the desalination plant.
- Physical interaction between species and project infrastructure: due to potential effects on prey abundance as a result of entrainment.
- Inter-pathways effects.
- In-combination effects with other plans and projects.

All other qualifying features

- Disturbance effects on species populations: due to potential effects of (i) airborne noise during construction of the desalination plant; and (ii) anthropogenic activity (leading to visual disturbance) during construction of the desalination plant.
- Inter-pathways effects.
- In-combination effects with other plans and projects.

iii. For the Outer Thames Estuary SPA:

Breeding little tern, breeding common tern and non-breeding red-throated diver

- Water quality effects – marine environment: due to potential effects of increases in SSC.
- Disturbance effects on species populations: due to potential effects of (i) underwater noise from dredging and removal of headworks; and (ii) artifical lighting during construction of the desalination plant.
- Physical interaction between species and project infrastructure: due to potential effects on prey abundance as a result of entrainment.
- Inter-pathways effects.
- In-combination effects with other plans and projects.

d) European sites with marine mammal qualifying features

5.3.90 The potential effects screened in for grey seal from the Humber Estuary SAC are:

- Water quality effects – marine environment:
- Changes in suspended sediments – dredging.
- Increase in heavy metal concentrations.
- Disturbance effects on species populations:
- Underwater noise – dredging and removal.
- Potential effects on prey are:

- Changes in suspended sediments.
- Increase in heavy metal concentrations.
- Underwater noise.
- Habitat change -removal of substratum.
- Entrainment.
- Inter-pathways effects.
- In-combination effects with other plans and projects.

5.3.91 The potential effects screened in for the Southern North Sea SAC, designated for harbour porpoise are:

- Water quality effects – marine environment:
- Changes in suspended sediments – dredging.
- Increase in heavy metal concentrations.
- Disturbance effects on species populations:
- Underwater noise – dredging and removal.
- Direct habitat loss and direct / indirect habitat fragmentation:
- Habitat change -removal of substratum.
- Potential effects on prey are the same as those outlined above for grey seal.
- Inter-pathways effects.
- In-combination effects with other plans and projects.

5.3.92 The potential effects screened in for harbour seal from The Wash and North Norfolk Coast SAC are:

- Water quality effects – marine environment:
- Changes in suspended sediments – dredging.
- Increase in heavy metal concentrations.

- Disturbance effects on species populations:
- Underwater noise – dredging and removal.
- Potential effects on prey are the same as those outlined above for grey seal.
- Inter-pathways effects.
- In-combination effects with other plans and projects.

6 UPDATE TO BASELINE CONDITIONS

6.1.1 Since the **Shadow HRA Report** [APP-145] and first **Shadow HRA Addendum** [AS-178] were prepared, the reference populations used in the marine mammal assessments have been updated, as outlined **Table 6.1**. Therefore, the marine mammal assessments in **Section 9** have been based on the updated reference populations, as well as the previous reference populations to allow a like-for-like comparison.

Table 6.1: Updated Marine Mammal Reference Populations

Species	Previous Reference Population used in Shadow HRA Report [APP-145] and first Shadow HRA Addendum [AS-178]	Updated Reference Populations
Harbour porpoise	345,373 (North Sea Management Unit population estimate based on SCANS-III; Ref. 6.1)	346,601(North Sea Management Unit population; Ref. 6.3).
Grey seal	8,716 (South-East England Management Unit; Ref. 6.2). 6,526 grey seal based on the count at the Donna Nook haul-out site (Ref. 6.2).	8,667 (South-East England Management Unit; Ref. 6.4). 5,265 grey seal based on the latest available count at the Donna Nook haul-out site (Ref. 6.4).
Harbour seal	4,965 (South-East England Management Unit; Ref. 6.2). 3,609 harbour seal based on count at The Wash and Blakeney Point haul-out sites (Ref. 6.2).	3,752 (South-East England Management Unit; Ref. 6.4). 2,744 harbour seal based on the latest available count at The Wash (2,415) and Blakeney Point (329) haul-out sites (Ref. 6.4).

7 INFORMATION FOR APPROPRIATE ASSESSMENT: COASTAL, FRESHWATER AND TERRESTRIAL HABITATS

7.1 Potential overarching coastal process effects

a) Dredging and dredge spoil disposal

7.1.1 Dredging for the desalination plant headworks would temporarily increase the water depth, slightly reducing current speeds with a minor influence on wave propagation and refraction. While the outfall head would be close to the assessed location of one of the FRR heads on the seaward flank of the outer bar, and the effect of dredging would be the same as assessed in the Shadow HRA Report for the FRR.

7.1.2 A worst-case suspended sediment plume would be short-lived (up to two days before dispersion reduces it to background concentrations) and deposition would be local to the point of dredging.

7.1.3 Dredging for the headworks would not occur at the same time as dredging for construction of other marine infrastructure required a part of the Sizewell C Project (e.g. FRR).

7.1.4 Disposal of dredged material would temporarily locally reduce water depth and potentially slightly constrict or deflect currents and increase drag on propagating waves until any small mound forming had dispersed. Dispersal is predicted to be very short term (days). The dredged material would be disposed of within 500m of the dredge location and, therefore, sediment would be retained within the longshore transport system.

7.1.5 With respect to coastal processes, dredging and dredged spoil disposal would have no effect on the screened in European sites

b) Drilling for connection to headworks

7.1.6 The desalination plant headworks would be placed on subterranean tunnels constructed by HDD. No excavated material from the tunnels would be released into the marine environment; however, drilling could cause small changes in SSC by suspending local bed sediment. The area of seabed affected is very small (less than 150m^2 each for the intake and outfall head).

7.1.7 In light of the above, it is concluded that, with respect to coastal processes, drilling for connection to headworks would have no effect on the screened in European sites.

c) Construction platform operations

7.1.8 Legs from jack-up construction barges used to carry out head emplacement works and during decommissioning would penetrate the seabed and would temporarily deflect currents, giving rise to small sediment plumes and initiation of scour. This would, however, be a low magnitude, short-term, temporary and very localised effect, with no potential for an effect on the screened in European sites.

d) Physical presence of the intake and outfall heads

7.1.9 The **Fourth ES Addendum** (Doc Ref. 6.18) describes the potential effect of the intake and outfall heads in terms of seabed scour. In summary, the area of effect is highly localised, with the predicted scale of effect being less then 10m in any direction form the location of each structure. The presence of the structures would have no effect on the screened in European sites.

7.2 Updated assessment – Minsmere to Walberswick Heaths and Marshes SAC

a) Annual vegetation of drift lines and perennial vegetation of stony banks

i. Alteration of coastal processes / sediment transport

7.2.1 Based on the evidence presented in **Section 7.1**, the proposed change would have no effect on coastal processes and sediment transport for the 'annual vegetation of drift lines' and 'perennial vegetation of stony banks' qualifying interest features of the Minsmere to Walberswick Heaths and Marshes SAC.

7.2.2 SSC would reduce to background levels very rapidly and sediment deposited from any plume would be restricted to offshore areas and be too remote to interact with the beaches.

7.2.3 The changes in tidal currents and sediment transport would be confined to the local area around the structures and there would be no larger scale change to coastal processes and sediment transport along the regional coast.

7.2.4 The proposed change does not alter the findings of the **Shadow HRA Report** [APP-145] and the Shadow HRA Report Addendum [AS-173], and no effect on the qualifying features of the SAC is predicted. Therefore, it is concluded that there would not be an adverse effect on the integrity of the Minsmere to Walberswick Heaths and Marshes SAC.

ii. Water quality effects – marine environment

7.2.5 This effect pathway was screened in due to the potential for increases in SSC during the construction phase. This effect has been assessed as part of the 'alteration of coastal processes / sediment transport' and, as concluded in Section 7.2 a) i), the proposed change does not alter the findings of the Shadow HRA Report [APP-145] and the Shadow HRA Report Addendum [AS-173]. Therefore, it is concluded that there would not be an adverse effect on the integrity of the Minsmere to Walberswick Heaths and Marshes SAC

7.3 Updated assessment – Minsmere-Walberswick Ramsar site (habitat features)

7.3.1 The assessment reported in **Section 7.2** applies to the habitat features of the Minsmere-Walberswick Ramsar site.

7.3.2 The proposed change does not alter the findings of the **Shadow HRA Report** [APP-145] and the Shadow HRA Report Addendum [AS-173]. Therefore, it is concluded that there would not be an adverse effect on the integrity of the Minsmere-Walberswick Ramsar site.

7.4 Updated assessment – Inter-pathway effects

7.4.1 As reported in section 7.2 a ii), the potential effect on water quality of relevance to Proposed Change 19 is the potential for increase in SSC, and this effect also forms part of the assessment of the 'alteration of coastal processes / sediment transport' pathway. All potential inter-pathway effects of Proposed Change 19 of relevance to Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar site are, therefore, already assessed in sections 7.2 and 7.3.

7.4.2 The potential for inter-pathway effects within the wider Sizewell C Project were further assessed within **Appendix 1A** of the first **Shadow HRA Addendum** [AS-174]. That assessment concluded that the 'alteration of coastal processes / sediment transport' effect pathway does not have any influence on the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar site, and could not interact with other pathways to result in a different effect. Given the conclusions drawn in sections 7.2 and 7.3 with respect to the potential effect of Proposed Change 19, the assessment on inter-pathway effects reported in **Appendix 1A** of the first **Shadow HRA Addendum** [AS-174] is unchanged.

7.5 Updated assessment – In-combination effects

7.5.1 The Shadow HRA Report [APP-145] concluded that there is the potential for an in-combination effect to occur due to potential changes in coastal processes / sediment transport arising from the construction, operation and decommissioning of the Sizewell C Project and the Suffolk Shoreline Management Plan (SMP) coastal management options.

7.5.2 The Shadow HRA Report [APP-145] concluded that the effects of the Sizewell C Project, when assessed in-combination with the proposed management activities set out in the Suffolk SMP, do not have the potential to cause an in-combination effect on coastal processes / sediment transport. The changes to coastal processes / sediment transport due to the Sizewell C Project would be very small scale / localised, with no potential to interact with the proposed management activities of the SMP.

7.5.3 The potential effect of Proposed Change 19 are within the envelope of those assessed for the wider Sizewell C Project and, therefore, the conclusion of Shadow HRA Report [APP-145] is unchanged with regard to in-combination effects on the habitat qualifying features of the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick Ramsar site.

8 INFORMATION FOR APPROPRIATE ASSESSMENT: BIRDS

8.1 Updated assessment – Alde-Ore Estuary SPA and Ramsar site

a) Breeding little tern, breeding Sandwich tern and breeding lesser black-backed gull

i. Alteration of coastal processes / sediment transport

8.1.1 Details of the activities associated with the construction and operation of Proposed Change 19 which could affect coastal processes are set out in **Sections 5.3 a)** and **7.1 a)** – **d)** above. Based upon these details it is clear that the potential effects extend over small areas and are highly localised around the location of the activities (e.g. sediment deposition from dredging, seabed areas affected by drilling for connection of the headworks and seabed scour around the intake and outfall headworks).

8.1.2 In addition, no effects on coastal processes or sediment transport on the Alde-Ore Estuary SPA (and Ramsar site) bird populations are predicted to arise as a result of the construction, operation and decommissioning of other marine structures associated with the main development site,

including the discharge outfall, cooling water infrastructure, FRR system, BLF and flood defence and coastal protection measures (as detailed in **Section 8.3 b) i.** of the **Shadow HRA Report** [APP-145]). The construction and operation of the desalination plant is associated with smaller and more localised effects than for this much wider range of marine structures (**Fourth ES Addendum** (Doc Ref. 6.18)). Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.1.3 Given the above, together with the fact that the Alde-Ore Estuary SPA (and Ramsar site) is located approximately 5km south of the main development site, no effects are predicted on the Alde-Ore Estuary SPA breeding populations of little tern, Sandwich tern and lesser black-backed gull due to alteration of the coastal processes and sediment transport as a result of the construction, operation and removal of Proposed Change 19.

ii. Water quality effects – marine environment

8.1.4 Effects on marine water quality could potentially arise as a result of increases in SSC that would result from dredging undertaken prior to the installation of the seawater intake and outfall headworks. As outlined above (**Sections 5.3 a) ii.** and **5.3 a) iii.**), this activity is assumed to produce the same increase in SSC as the dredging for the FRR and CDO head, which would be located close to the seawater intake and outfall headworks for the desalination plant (**Figure 3.1** in **Fourth ES Addendum** (Doc Ref. 6.18)).

8.1.5 On the basis of the relatively small areas and short duration of the sediment plumes predicted to be produced from the dredging for the FRR and CDO head, as well as for the BLFs (see **Section 8.8 e) ii.** in the **Shadow HRA Report** [APP-145]), effects on marine water quality during the construction period were screened out in relation to the Alde-Ore Estuary SPA (and Ramsar site). These sediment plumes would have no spatial overlap with the predicted foraging range of little tern from the Alde-Ore Estuary SPA (and Ramsar site), whilst they would represent such a small proportion of the predicted foraging ranges of the Sandwich tern and lesser black-backed gull populations from this SPA that it would virtually inconceivable for their foraging efficiency to be affected (noting that their mean maximum foraging ranges are estimated as 34km (Sandwich tern) and 127km (lesser black-backed gull) (Ref. 8.1).

8.1.6 It is also the case that the dredging for the installation of the seawater intake and outfall headworks would not be coincident with that for the FRR and CDO head, so there would be no additive effects in terms of increased plume areas. However, it is feasible that dredging activities could coincide with maintenance dredging for the enhanced permanent BLF. The impact

of combined dredge plumes for the BLF maintenance and dredging for the FRR was empirically modelled (in Volume 2, Chapter 22, Appendix 22J [APP-327]) and it was concluded that coincidence of the dredge activities would not result in changes in the original assessments (see **Section 8.8 e) ii.** of the **Shadow HRA Report** [APP-145] and **Section 8.7 c) ii.** of the first **Shadow HRA Addendum** [AS-173]). Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.1.7 Given the above, no effects are predicted on the Alde-Ore Estuary SPA breeding populations of little tern, Sandwich tern and lesser black-backed gull due to effects on marine water quality.

iii. Physical interaction between species and project infrastructure

8.1.8 As described in **Section 5.3 a) x.**, phytoplankton, zooplankton, ichthyoplankton and fish could be entrained during seawater abstraction into the desalination plant. However, no impingement of fish would result from the construction, operation or removal of the desalination plant.

8.1.9 The entrainment associated with the desalination plant could, potentially, reduce prey availability for the Alde-Ore Estuary SPA (and Ramsar site) populations of little tern, Sandwich tern and lesser black-backed gull.

8.1.10 The abstraction rate for the desalination plant would be substantially lower than that for the proposed cooling water abstraction during the operational period, so that the potential effects of the entrainment associated with the desalination plant on phytoplankton, zooplankton, ichthyoplankton and fish are correspondingly lower (see **Section 5.3 a) x.**). It is also the case that the abstraction for the desalination plant would occur over a relatively small number of years during the construction period, whereas the proposed cooling water abstraction would occur for the full duration of the operation of Sizewell C.

8.1.11 The potential (combined) effects of entrainment and impingement associated with the cooling water abstraction on the prey availability for the Alde-Ore Estuary SPA (and Ramsar site) populations of little tern, Sandwich tern and lesser black-backed gull were assessed, (**Sections 8.3 b) vii.**, **8.3 c) vii.** and **8.3 d) vii.** in the **Shadow HRA Report** [APP-145]), with the conclusion being that this would not lead to adverse effects on these populations. Further investigation of the effects on key fish groups demonstrated that the predicted levels of localised depletion resulting from the combined operation of Sizewell C and Sizewell B are orders of magnitude lower than the estimated annual variation in the abundance of these fish groups at the local scale (**Volume 3, Appendix 2.17A** of the **ES**

Addendum (Doc. Ref 6.14) [REP6-016]). This suggests that these effects on prey abundance will be indiscernible relative to the levels of variability in prey abundance that these birds experience under baseline conditions. Therefore, in this context, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.1.12 Given the above, no effects are predicted on the Alde-Ore Estuary SPA breeding populations of little tern, Sandwich tern and lesser black-backed gull due to physical interaction between species and project infrastructure.

8.2 Updated assessment – Minsmere–Walberswick SPA and Ramsar site

a) All SPA/Ramsar site qualifying features except breeding little tern

i. Disturbance effects on species populations

8.2.1 For all of the qualifying features of the Minsmere-Walberswick SPA other than little tern, disturbance effects on species populations is the only pathway of relevance (as determined by the LSE screening – **Appendix B.2** of the **Shadow HRA Report** (Doc Ref. 5.10)). For these qualifying features, there is potential for disturbance effects to arise from airborne noise and visual sources (e.g. movements of vehicles and other activities associated with the construction phase of Proposed Change 19).

8.2.2 In relation to airborne noise, the effects of the directional drilling associated with the construction phase of Proposed Change 19 have been considered in terms of the previously assessed noise levels associated with the construction of the main development site (and as presented in **Section 8.8** of the **Shadow HRA Report** [APP-145] and **Section 8.3** in the first **Shadow HRA Report Addendum** [AS-173]). As detailed in the **Fourth ES Addendum** (Doc Ref. 6.18), this concludes that during daytime the directional drilling is not predicted to change the previously assessed construction noise levels, whilst at night-time there are only very small increases in the predicted noise levels at a small number of the receptors used.

8.2.3 In relation to visual disturbance, the approach used to the assessment for SPA qualifying features in the **Shadow HRA Report** [APP-145] was to assume that such potential effects extend over a defined, fixed, buffer zone (referred to as the 'potential visual impact zone'). This buffer zone was determined on the basis of the available evidence from the published literature relating to the effects of such disturbance on bird responses and extended either 150m or 300m from the boundary of the main development

site, dependent on the extent of natural screening along this boundary (as detailed in **Section 8.8 b) iv.** in the **Shadow HRA Report** [APP-145]). Therefore, activities associated with the desalination plant which could contribute to potential visual disturbance will be captured in the approach that has been taken to the existing assessment in the **Shadow HRA Report** [APP-145]. Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.2.4 Given the above, no effects are predicted on the Minsmere-Walberswick SPA (and Ramsar site) qualifying features as a result of airborne noise and visual disturbance.

b) Breeding little tern

i. Alteration of coastal processes / sediment transport

8.2.5 As described in relation to the Alde-Ore Estuary SPA above (**Section 8.1**), the potential effects on coastal processes resulting from the desalination plant extend over small areas and are highly localised around the location of the activities.

8.2.6 The scale of these potential effects is considered to be substantially smaller than those already assessed in **Section 8.8 e) i.** in the **Shadow HRA Report** [APP-145], which were found not to lead to any adverse effects on the Minsmere-Walberswick SPA little tern population. As such, it is considered that, in common with conclusions relating to the Minsmere to Walberswick Heaths and Marshes SAC (**Section 7.2 a) i**.), any resulting effects on coastal processes would be insufficient to have the potential to cause adverse effects on the SPA little tern population and would not change conclusions of the Shadow HRA Report [APP-145].

ii. Water quality effects – marine environment

8.2.7 As described in relation to the Alde-Ore Estuary SPA above (**Section 8.1**), effects on marine water quality could potentially arise as a result of increases in SSC that would result from dredging undertaken prior to the installation of the seawater intake and outfall headworks. This activity is assumed to produce the same increase in SSC as the dredging for the FRR and CDO head, which would be located close to the seawater intake and outfall headworks for the desalination plant (**Figure 3.1** in **Fourth ES Addendum** (Doc Ref. 6.18)).

8.2.8 The assessment undertaken on the effects of increased SSC due to dredging for the FRR and CDO head demonstrated that the resulting

sediment plumes are predicted to have little overlap (less than 4%) with the likely foraging ranges of little tern from the breeding colonies within the SPA (**Table 8.16** in the **Shadow HRA Report** [APP-145]). In addition, the sediment plumes from dredging for the desalination plant would be transient (as for the FRR and CDO head), so any effects would be short term, whilst the timing of these works is not expected coincide with any of the other dredging proposed as part of the Sizewell C Project (with the possible exception of maintenance dredging for the enhanced permanent BLF). Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.2.9 Given the above, no effects are predicted on the Minsmere-Walberswick SPA (and Ramsar site) breeding population of little tern due to effects on marine water quality.

iii. Disturbance effects on species populations

Disturbance at the colony

8.2.10 The details set out in **Section 8.2 a) i.** above, in relation to the other qualifying features of the Minsmere-Walberswick SPA, are considered to apply equally to the little tern qualifying feature when present at the colony. As such, it is concluded that disturbance from airborne noise and visual sources would have no effects on the SPA little terns when they are present at the breeding colonies.

Disturbance effects in the marine environment

8.2.11 The SPA little tern population could also be affected by noise and visual disturbance when away from the nesting colony and foraging in the marine environment. In relation to the desalination plant, such effects could occur as a result of direct effects of artificial lighting or indirectly as a result of the effects of underwater noise (due to dredging) on the fish prey species of little tern.

8.2.12 Given that artificial lighting around the desalination plant would be highly localised in its effects and little tern do not generally forage during the nocturnal period (Ref. 8.2; Ref. 8.3), no effects of this disturbance source are predicted on the SPA little tern population.

8.2.13 In terms of indirect effects resulting from effects of underwater noise on fish prey species, mortality and recoverable injury of fish are predicted to extend over very small areas only as a result of the dredging associated with the desalination plant (as detailed in **Section 5.3 a) v.**). Behavioural effects

and TTS in fish would extend over greater areas (up to 6.7km^2 and 1.7km^2, respectively), with the areas in which these effects occur likely to overlap with the predicted foraging range of SPA little terns from the Minsmere colony but not the Dingle colony (as is the case for the dredging associated with the FRR, CDO head and permanent BLF – see **Section 8.8, e) vi.** in the **Shadow HRA Report** [APP-145]). The overlap with the foraging range of birds from the Minsmere colony is likely to be relatively extensive but would be less than that considered in the cumulative dredging scenario already assessed, given the considerably smaller areas over which these effects would extend (i.e. see **Table 8.17** in the **Shadow HRA Report** [APP-145]). In addition, the dredging for the desalination plant would not add to the potential cumulative dredging effects assessed in the **Shadow HRA Report** [APP-145] because the timing of these works is not expected coincide with any of the other dredging proposed as part of the Sizewell C Project (with the possible exception of maintenance dredging for the enhanced permanent BLF).

8.2.14 Behavioural responses of fish (which could range from startle responses to displacement) only have the potential to temporarily affect prey availability to the SPA little tern population, with any reduction in prey availability within the affected area expected to be limited to the duration of the activity. The extent of the duration and magnitude of TTS experienced by the affected fish may be variable, whilst fish experiencing TTS may have reduced fitness (including decreased ability to detect predators). As such, it is considered that dredging for the desalination plant would not result in adverse effects on the SPA (and Ramsar site) little tern population due to indirect effects on their fish prey.

8.2.15 Based upon the above, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged. Given this, no effects are predicted on the Minsmere-Walberswick SPA (and Ramsar site) breeding population of little tern due to effects of noise and visual disturbance.

iv. Physical interaction between species and project infrastructure

8.2.16 As detailed in **Section 8.1 a) iii.**, the abstraction rate for the desalination plant would be substantially lower than that for the proposed cooling water abstraction during the operational period, so that the potential effects of the entrainment associated with the desalination plant on phytoplankton, zooplankton, ichthyoplankton and fish are correspondingly lower (see **Section 5.3 a) x.**) than for the operational cooling water intake. It is also the case that the abstraction for the desalination plant would occur over a relatively small number of years during the construction period, whereas

the proposed cooling water abstraction would occur for the full duration of the operation of the Sizewell C Project.

8.2.17 The potential (combined) effects of entrainment and impingement associated with the cooling water abstraction on the prey availability for the Minsmere-Walberswick SPA (and Ramsar site) little tern population have been assessed, with the conclusion being that this would not lead to adverse effects on this population (**Section 8.8 e) viii.** in the **Shadow HRA Report** [APP-145]). Further investigation of the effects on key fish groups demonstrates that the predicted levels of localised depletion resulting from the combined operation of Sizewell C and Sizewell B are orders of magnitude lower than the estimated annual variation in the abundance of these fish groups at the local scale (**Volume 3, Appendix 2.17A** of the **ES Addendum** (Doc. Ref 6.14) [REP6-016]). This suggests that these effects on prey abundance will be indiscernible relative to the levels of variability in prey abundance that these birds experience under baseline conditions. Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.2.18 Given the above, no effects are predicted on the Minsmere-Walberswick SPA (and Ramsar site) breeding population of little tern due to physical interaction between species and project infrastructure.

8.3 Updated assessment – Outer Thames Estuary SPA

a) Breeding little tern

i. Water quality effects – marine environment

8.3.1 As outlined in **Section 6.3** of the **Shadow HRA Report** [APP-145], several little tern colonies (associated with a number of different SPAs) contribute to the Outer Thames Estuary SPA little tern population. Only a proportion of these 'contributing' SPA populations are 'screened into' the current assessment, with others being too distant from the main development site (and the associated development sites) for there to be any likely pathways to effects.

8.3.2 Specifically, potential effects resulting from changes in marine water quality associated with the desalination plant are limited to those colonies within the Alde-Ore Estuary SPA (and Ramsar site) and the Minsmere-Walberswick SPA (and Ramsar site). As detailed above (**Sections 8.1 a) ii.** and **8.2 b) ii.**), no effects are predicted on little tern from either of these SPAs as a result of effects on marine water quality associated with the desalination plant.

8.3.3 Based upon the above, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged. Given this, it follows that no effects are predicted on the Outer Thames Estuary SPA breeding population of little tern due to effects on marine water quality.

ii. Disturbance effects on species populations

8.3.4 No effects of noise and visual disturbance are predicted on little terns from the Minsmere-Walberswick SPA (and Ramsar site) (**Section 8.2 b) iii.**), whilst other little tern colonies contributing to the Outer Thames Estuary SPA population are not screened in for this effect (because their greater distance from the sources of such disturbance mean that there is no potential for disturbance, either when birds are present at the colony or when foraging in the marine environment). On this basis, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged. Therefore, no effects are predicted on the Outer Thames Estuary SPA breeding population of little tern due to disturbance effects on species populations.

iii. Physical interaction between species and project infrastructure

8.3.5 It is concluded above (**Sections 8.1 a) iii.** and **8.2 b) iv.**) that the entrainment of phytoplankton, zooplankton, ichthyoplankton and fish due to abstraction for the desalination plant would not result in adverse effects on the Alde-Ore Estuary SPA (and Ramsar site) and Minsmere-Walberswick SPA (and Ramsar site) little tern populations. Additionally, there considered to be no potential for this entrainment to have effects on little terns from any of the other breeding colonies that contribute to the Outer Thames Estuary SPA population. On this basis, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged. Therefore, no effects are predicted on the Outer Thames Estuary SPA breeding population of little tern due to physical interaction between species and project infrastructure.

b) Breeding common tern

i. Water quality effects – marine environment

8.3.6 As outlined in **Section 6.3** of the **Shadow HRA Report** [APP-145], several common tern breeding colonies contribute to the Outer Thames Estuary

SPA common tern population. Marine water quality effects associated with the Sizewell C Project have the potential to affect those colonies which are located within the Alde-Ore Estuary SPA and Minsmere-Walberswick SPA, noting that common tern is not a qualifying feature of either of these SPAs (see **Table 6.17** in the **Shadow HRA Report** [APP-145]).

8.3.7 In relation to the desalination plant, effects on marine water quality could potentially arise as a result of increases in SSC that would result from dredging undertaken prior to the installation of the seawater intake and outfall headworks. As outlined above (**Sections 5.3 a) ii.** and **5.3 a) iii.**), this activity is assumed to produce the same increase in SSC as the dredging for the FRR and CDO headworks, which would be located close to the seawater intake and outfall headworks for the desalination plant (**Figure 3.1** in **Fourth ES Addendum** (Doc Ref. 6.18)).

8.3.8 The assessment undertaken on the effects of increased SSC due to dredging for the FRR and CDO headworks demonstrated that the resulting sediment plumes are predicted to have little overlap (less than 1%) with the likely foraging ranges of common tern from the breeding colonies located within either the Alde-Ore Estuary SPA or Minsmere-Walberswick SPA (see **Table 8.26** in the **Shadow HRA Report** [APP-145]). In addition, the sediment plumes from dredging for the desalination plant would be transient (as for the FRR and CDO headworks), so any effects would be short term, whilst the timing of these works is not expected coincide with any of the other dredging proposed as part of the Sizewell C Project (with the possible exception of maintenance dredging for the enhanced permanent BLF). Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.3.9 Given the above, no effects are predicted on the Outer Thames Estuary SPA population of common tern due to effects on marine water quality.

ii. Disturbance effects on species populations

8.3.10 As described above for the Minsmere-Walberswick SPA little tern population in relation to the desalination plant, the Outer Thames Estuary SPA common tern population could be affected by noise and visual disturbance when foraging in the marine environment. Such effects could occur as a result of direct effects of artificial lighting or indirectly as a result of the effects of underwater noise (due to dredging) on the fish prey species of common tern.

8.3.11 Given that artificial lighting around the desalination plant would be highly localised in its effects and common tern do not generally forage during the

nocturnal period (Ref. 8.3), no effects of this disturbance source are predicted on the SPA common tern population.

8.3.12 In terms of indirect effects resulting from effects of underwater noise on fish prey species, mortality and recoverable injury of fish are predicted to extend over very small areas only as a result of the dredging associated with the desalination plant (as detailed in **Section 5.3 a) v.** above). Behavioural effects and TTS in fish would extend over greater areas (up to 6.7km^2 and 1.7km^2, respectively). The mean maximum foraging range of common tern is estimated as 17.6km (Ref. 8.1), so that these effects would occur within the expected foraging ranges of common tern from the (non-SPA) colonies located within the Alde-Ore Estuary SPA and Minsmere-Walberswick SPA. However, the areas over which such effects on fish would occur would represent a small percentage of the common tern foraging ranges (i.e. less than 1% even for the behavioural effects, which would likely be short-term). In addition, the dredging for the desalination plant would not add to the potential cumulative dredging effects assessed in the **Shadow HRA Report** [APP-145] because the timing of these works is not expected coincide with any of the other dredging proposed as part of the Sizewell C Project (with the possible exception of maintenance dredging for the enhanced permanent BLF).

8.3.13 Based upon the above, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged. Given this, no effects are predicted on the Outer Thames Estuary SPA population of common tern due to effects of noise and visual disturbance.

iii. Physical interaction between species and project infrastructure

8.3.14 As detailed in **Section 8.1 a) iii.** above, the abstraction rate for the desalination plant would be substantially lower than that for the proposed cooling water abstraction during the Sizewell C operational period, so that the potential effects of the entrainment associated with the desalination plant on phytoplankton, zooplankton, ichthyoplankton and fish are correspondingly lower (see **Section 5.3 a) x.**) than for the operational cooling water intake. It is also the case that the abstraction for the desalination plant would occur over a relatively small number of years during the construction period, whereas the proposed cooling water abstraction would occur for the full duration of the operation of the Sizewell C Project.

8.3.15 The potential (combined) effects of entrainment and impingement associated with the cooling water abstraction on the prey availability for the Outer Thames Estuary SPA common tern population have been assessed,

with the conclusion being that this would not lead to adverse effects on this population (**Section 8.10 c) iii.** in the **Shadow HRA Report** [APP-145]). Further investigation of the effects on key fish groups demonstrates that the predicted levels of depletion at a series of more localised scales resulting from the combined operation of Sizewell C and Sizewell B are orders of magnitude lower than the estimated annual variation in the abundance of these fish groups at the local scale (**Volume 3, Appendix 2.17A** of the **ES Addendum** (Doc. Ref 6.14) [REP6-016]). This suggests that these effects on prey abundance will be indiscernible relative to the levels of variability in prey abundance that these birds experience under baseline conditions. Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged.

8.3.16 Given the above, no effects are predicted on the Outer Thames Estuary SPA population of common tern due to physical interaction between species and project infrastructure.

c) Non-breeding red-throated diver

i. Water quality effects – marine environment

8.3.17 As described above, effects on marine water quality could potentially arise as a result of increases in SSC that would result from dredging undertaken prior to the installation of the seawater intake and outfall headworks. This activity is assumed to produce the same increase in SSC as the dredging for the FRR and CDO headworks, which would be located close to the seawater intake and outfall headworks for the desalination plant (**Figure 3.1** in **Fourth ES Addendum** (Doc Ref. 6.18)). As such, the resulting sediment plumes would represent a very small extent of the foraging area available to non-breeding red-throated diver within the Outer Thames Estuary SPA (i.e. an area of 392.5km^2). In addition, the sediment plumes from dredging for the desalination plant would be transient (as for the FRR and CDO headworks), so any effects would be short term, whilst the timing of these works is not expected coincide with any of the other dredging proposed as part of the Sizewell C Project. Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged..

8.3.18 Given the above, no effects are predicted on the Outer Thames Estuary SPA non-breeding population of red-throated diver due to effects on marine water quality.

ii. Disturbance effects on species populations

8.3.19 As for the SPA populations of little tern and common tern, there is potential for disturbance effects on the non-breeding red-throated diver population as a result of direct effects of artificial lighting or indirectly as a result of the effects of underwater noise (due to dredging) on the fish prey species of red-throated diver.

8.3.20 Given that artificial lighting around the desalination plant would be highly localised it would extend over a very small part of the SPA area only, and any effects on the SPA non-breeding red-throated diver population would be minimal.

8.3.21 In terms of indirect effects resulting from effects of underwater noise on fish prey species, mortality and recoverable injury of fish are predicted to extend over very small areas only as a result of the dredging associated with the desalination plant (as detailed in **Section 5.3 a) v.** above). Behavioural effects and TTS in fish would extend over greater areas (up to 6.7km^2 and 1.7km^2, respectively). Therefore, these effects would extend over a very small part of the foraging area available to non-breeding red-throated diver within the Outer Thames Estuary SPA (i.e. approximately 1.5% even for the behavioural effects, which would likely be short-term). In addition, the dredging for the desalination plant would not add to the potential cumulative dredging effects assessed in the **Shadow HRA Report** [APP-145] because the timing of these works is not expected coincide with any of the other dredging proposed as part of the Sizewell C Project (with the possible exception of maintenance dredging for the enhanced permanent BLF, which would not add in any significant way to the potential effects).

8.3.22 Based upon the above, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged. Given this, no effects are predicted on the Outer Thames Estuary SPA population of non-breeding red-throated diver due to effects of noise and visual disturbance.

iii. Physical interaction between species and project infrastructure

8.3.23 As detailed in **Section 8.1 a) iii.** above, the abstraction rate for the desalination plant would be substantially lower than that for the proposed cooling water abstraction during the Sizewell C operational period, so that the potential effects of the entrainment associated with the desalination plant on phytoplankton, zooplankton, ichthyoplankton and fish are correspondingly lower (see **Section 5.3 a) x.** above) than for the operational cooling water intake. It is also the case that the abstraction for the desalination plant would occur over a relatively small number of years

during the construction period, whereas the proposed operational cooling water abstraction would occur for the full duration of the operation of the Sizewell C Project.

8.3.24 The potential (combined) effects of entrainment and impingement associated with the cooling water abstraction on the prey availability for the Outer Thames Estuary SPA non-breeding red-throated diver population have been assessed, with the conclusion being that this would not lead to adverse effects on this population (**Section 8.10 d) iii.** in the **Shadow HRA Report** [APP-145]). Further investigation of the effects on key fish groups demonstrates that the predicted levels of depletion at a series of more localised scales resulting from the combined operation of Sizewell C and Sizewell B are orders of magnitude lower than the estimated annual variation in the abundance of these fish groups at the local scale (**Volume 3, Appendix 2.17A** of the **ES Addendum** (Doc. Ref 6.14) [REP6-016]). This suggests that these effects on prey abundance will be indiscernible relative to the levels of variability in prey abundance that these birds experience under baseline conditions. Therefore, effects from Proposed Change 19 remain within the scale of effects assessed previously in the **Shadow HRA Report** [APP-145] and the first **Shadow HRA Addendum** [AS-173] and the conclusion of no adverse effect on integrity is unchanged..

8.3.25 Given the above, no effects are predicted on the Outer Thames Estuary SPA population of non-breeding red-throated diver due to physical interaction between species and project infrastructure.

8.4 Updated assessment – Inter-pathway effects

8.4.1 The potential for inter-pathway effects on the qualifying features of SPAs (and Ramsar sites, in terms of their ornithology features) have been considered for the Sizewell C Project in **Appendix 1A** of the **Shadow HRA Addendum** [AS-174]. This identified no likely inter-pathway effects for any of the SPAs (or Ramsar sites) for which potential effects associated with the desalination plant have been screened in (see **Tables 3.1**, **3.3** and **3.4** and **Sections 3.2**, **3.5** and **3.6** in [AS-174]).

8.4.2 For each of the effect pathways screened in for assessment in relation to the desalination plant for the Alde-Ore Estuary SPA (and Ramsar site), Minsmere-Walberswick SPA (and Ramsar site) and Outer Thames Estuary SPA, only small potential effects are identified (as detailed in **Sections 8.1 – 8.3** above). These potential effects are also limited to the construction period. On the basis of these points in conjunction with the details and findings of the assessment already undertaken in **Appendix 1A** of the **Shadow HRA Addendum** [AS-174], it is considered that the incorporation of the desalination plant into the Sizewell C proposals does not change the conclusion of no AEoI for the Alde-Ore Estuary SPA (and Ramsar site),

Minsmere-Walberswick SPA (and Ramsar site) and Outer Thames Estuary SPA as a result of potential inter-pathway effects.

8.5 Updated assessment – In-combination effects

8.5.1 As detailed in the **Shadow HRA Report** [APP-145], the screening exercise for plans or projects that could have an in-combination effect with the construction, operation and decommissioning of the Sizewell C Project identified possible likely significant in-combination effects for:

- The Alde-Ore Estuary SPA (and Ramsar site) in relation to alteration of coastal processes, changes to marine water quality and disturbance due to changes in recreational pressure.
- The Minsmere-Walberswick SPA (and Ramsar site) in relation to alteration of coastal processes, changes to marine water quality, disturbance effects on species populations and disturbance due to changes in recreational pressure.
- The Outer Thames Estuary SPA in relation changes to marine water quality and disturbance effects on species populations.

8.5.2 With the exception of disturbance due to changes in recreational pressure (for both the Alde-Ore Estuary SPA (and Ramsar site) and Minsmere-Walberswick SPA (and Ramsar site)), these effect pathways are relevant to the potential effects that are identified in relation to the proposed design change considered in this addendum.

8.5.3 Considering the plans and projects identified in relation to:

- The Alde-Ore Estuary SPA (and Ramsar site) for alteration of coastal processes (**Table 8.4** in Shadow HRA Report [APP-145]) and for changes to marine water quality (**Table 8.5** in Shadow HRA Report [APP-145]), it is considered that the effects associated with the desalination plant do not alter the previous conclusion that none of these plans or projects have the potential to result in an adverse in-combination effect with the Sizewell C Project on the Alde-Ore Estuary SPA (and Ramsar site).
- The Minsmere-Walberswick SPA (and Ramsar site) for alteration of coastal processes (**Table 8.22** in **Shadow HRA Report** [APP-145]), changes to marine water quality (**Table 8.23** in **Shadow HRA Report** [APP-145]) and disturbance to species populations (**Table 8.24** in **Shadow HRA Report** [APP-145]), it is considered that the effects associated with the desalination plant do not alter the previous conclusion that none of these plans or projects have the potential to

result in an adverse in-combination effect with the Sizewell C Project on the Minsmere-Walberswick SPA (and Ramsar site).

- The Outer Thames Estuary SPA for changes to marine water quality (**Table 8.29** in **Shadow HRA Report** [APP-145]) and disturbance to species populations (**Table 8.30** in **Shadow HRA Report** [APP-145]), it is considered that the effects associated with the desalination plant do not alter the previous conclusion that none of these plans or projects have the potential to result in an adverse in-combination effect with the Sizewell C Project on the Outer Thames Estuary SPA.

9 INFORMATION FOR APPROPRIATE ASSESSMENT: MARINE MAMMALS

9.1 Updated assessment - Humber Estuary SAC

a) Grey seal

i. Water quality effects – marine environment

9.1.1 As outlined in **Section** Error! Reference source not found., the potential water quality effects of the desalination plant on grey seal from the Humber Estuary SAC and their prey would be:

- Changes in suspended sediments during dredging.
- Increases in heavy metal concentrations.

9.1.2 The changes in suspended sediment and increases in heavy metal concentrations as a result of Proposed Change 19 would, as outlined below, not result in an increase to the maximum area over which changes in marine water quality (7.26km^2) could occur due to the Sizewell C Project, and which formed the basis of the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) (i.e. the effect would be within the assessed envelope).

9.1.3 As a precautionary approach, the number of grey seal that potentially could be present (and percentage of the updated reference population (see **Section** Error! Reference source not found.)) within this the maximum area of 7.26km^2 for overall changes in water quality has been updated.

9.1.4 The total number of foraging grey seal that could be present in the maximum area of 7.26km^2 is 0.3 individuals (based on worst-case density estimate used in **Shadow HRA Report** [**APP-145**] of 0.038 grey seal per km^2), this represents:

- up to 0.003% of the previous South-East England Management Unit reference population of 8,716 grey seal (or up to 0.005% of the previous estimated Humber Estuary SAC population of 6,526 grey seal based on the count at the Donna Nook haul-out site).

- up to 0.004% of the updated South-East England Management Unit reference population of 8,667 grey seal (or up to 0.006% of the updated estimated Humber Estuary SAC population of 5,265 grey seal based on the latest count at the Donna Nook haul-out site).

9.1.5 Therefore, due to the very small number of grey seal and the very low percentage of the SAC population that could be affected, **no adverse effects on the integrity of the Humber Estuary SAC** are predicted due to changes in water quality from the Sizewell C project in relation to the conservation objectives for grey seal.

Increased suspended sediment concentrations

9.1.6 Whilst there could be some increase in suspended sediment concentrations, the plume would be transitory, short-term in nature and within natural variation and the maximum area previously assessed.

9.1.7 As outlined in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]), increased turbidity as a result of dredging will not have a direct effect on foraging grey seal as they are not dependent on vision to forage. Grey seal are well adapted to existence in turbid coastal waters.

9.1.8 Grey seal have large foraging ranges and any highly localised prey displacement would not have a significant effect on grey seal foraging in the area.

9.1.9 Therefore, **no adverse effects on the integrity of the Humber Estuary SAC** are predicted from the increased suspended sediment which arises as a result of the dredging, including the dredging required for the desalination plant, in relation to the conservation objectives for grey seal.

Increases in heavy metal concentrations

9.1.10 As summarised in **Section** Error! Reference source not found., the maximum area affected by substances in the desalination discharge would be precautionarily estimated as less than 0.005km^2. This is within the maximum envelope for changes in water quality (7.26km^2) predicted for the Sizewell C Project as previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]).

9.1.11 Although the spatial area of exposure is small, the duration of the discharge is potentially several years, throughout the construction period.

9.1.12 Therefore, as a precautionary approach it is assumed that grey seal and their prey could be displaced from this area (0.005km^2) as a result of increased heavy metal concentrations in the brine discharge from the desalination plant.

9.1.13 This is highly precautionary as modelling of the worst-case discharge plume, using the maximum 10Ml per day (6Ml per day discharge) scenario, indicates the maximum area, calculated based on the tidal ellipse, above EQS (or detectable above background concentrations) is 0.0008km^2 for chromium (as detailed in **Appendix 3.A** of the **Fourth ES Addendum** (Doc Ref. 6.18)).

9.1.14 The total number of foraging grey seal that could be present in the maximum area of 0.005km^2 is 0.0002 individuals (based on worst-case density estimate used in **Shadow HRA Report** [APP-145] of 0.038 grey seal per km^2), this represents:

- up to 0.000002% of the previous South-East England Management Unit reference population of 8,716 grey seal (or up to 0.000003% of the previous estimated Humber Estuary SAC population of 6,526 grey seal based on the count at the Donna Nook haul-out site).

- up to 0.000002% of the updated South-East England Management Unit reference population of 8,667 grey seal (or up to 0.000004% of the updated estimated Humber Estuary SAC population of 5,265 grey seal based on the latest count at the Donna Nook haul-out site).

9.1.15 As outlined in **Section** Error! Reference source not found., the impact of chromium, lead and zinc exposure resulting from construction discharges, is predicted to have a negligible effect on fish. Any potential effects on fish are not significant at the sea area and regional stock/population levels.

9.1.16 Any displacement behaviour of fish due to discharges of heavy metals is predicted to be highly localised and exposure would represent a negligibly small proportion of fish in the GSB. Therefore, no significant changes in the availability as prey for foraging grey seal are predicted.

9.1.17 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), the limited spatial extent of zinc, lead and chromium discharges in the inshore waters mean the probability of exposure is minimal, especially as that uptake is only possible indirectly through the consumption of prey. In fish, the direct uptake of heavy metals occurs through the gills, and there is a potential for indirect effects through food webs. However, the fish assessment predicts

negligible effects of chromium, lead and zinc exposure on fish species due to minimal spatial exposure. No significant indirect effects through their prey are expected in marine mammals.

9.1.18 Grey seal have large foraging ranges and any highly localised prey displacement would not have a significant effect on grey seal foraging in the area.

9.1.19 The increases in heavy metal concentrations in the discharges from the desalination plant during construction will not occur at the same time or overlap with discharges during operation.

9.1.20 Therefore, **no adverse effects on the integrity of the Humber Estuary SAC** are predicted due to water quality effects from Sizewell C project, including any increased heavy metal concentrations from construction discharges associated with the desalination plant, in relation to the conservation objectives for grey seal.

ii. Disturbance effects on species populations

9.1.21 As outlined in **Section** Error! Reference source not found., the potential disturbance effects from underwater noise as a result of the desalination plant on grey seal from the Humber Estuary SAC and their prey would be:

- Underwater noise during dredging.
- Underwater noise during removal.

9.1.22 Underwater noise and potential disturbance effects during dredging prior to installation of the offshore infrastructure for the desalination plant and removal of the offshore infrastructure for the desalination plant would occur in the construction phase of the Sizewell C Project.

9.1.23 The potential distance from underwater noise during dredging and removal of the offshore infrastructure for the desalination plant would remain within the worst-case for underwater noise disturbance during the construction phase as previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178]. These assessments have been updated to reflect recent changes in reference populations (see **Section** Error! Reference source not found.).

9.1.24 In the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]), the maximum predicted area of disturbance from impact piling during construction was based on worst-case disturbance range of up to 26km, an area of up to 1,100.66km^2, which could affect up to 41.8 grey seal (0.48% of the previous South-East England Management Unit reference population; 0.64% of the previous Humber Estuary count).

9.1.25 Based on the updated reference population, as outlined in **Section** Error! Reference source not found., up to 41.8 grey seal, representing 0.48% of the updated South-East England Management Unit reference population of 8,667 grey seal (or up to 0.79% of the updated estimated Humber Estuary SAC population of 5,265 grey seal based on the latest count at the Donna Nook haul-out site), could be affected.

9.1.26 In the first **Shadow HRA Addendum** [AS-178], the maximum predicted area of disturbance from impact piling during construction was based on the current Statutory Nature Conservation Bodies (SNCB) guidance for assessing the significance of noise disturbance against conservation objectives of harbour porpoise SACs (Ref. 9.1). This guidance identifies noise generating activities that can potentially result in disturbance to harbour porpoise and provides recommended Effective Deterrence Ranges (EDR) for these activities. The recommended EDR for pin-piles is 15km (with or without mitigation; Ref. 9.1).

9.1.27 In the first **Shadow HRA Addendum** [AS-178], a precautionary disturbance area of up to up to 456.33km^2, based on a 15km EDR and worst-case pile location, was assessed for grey seal, although recommended for harbour porpoise SAC. The number of grey seal that could be disturbed is up to 17.34. This represents 0.21% of the previous South-East England Management Unit reference population of 8,199 grey seal (or 0.28% of the previous Humber Estuary count of 6,288 grey seal).

9.1.28 Based on the updated reference population, as outlined in **Section** Error! Reference source not found., up to 17.34 grey seal, represents 0.20% of the updated South-East England Management Unit reference population of 8,667 grey seal (or up to 0.33% of the updated estimated Humber Estuary SAC population of 5,265 grey seal based on the latest count at the Donna Nook haul-out site), could be affected.

9.1.29 It is highly unlikely that all foraging grey seal that could be disturbed as result of underwater noise during construction would be from the Humber Estuary SAC. There would be no direct effect or overlap with the SAC.

9.1.30 Taking into account the temporary disturbance and intermittent duration of underwater noise during construction, there is unlikely to be significant disturbance or barrier effects for foraging grey seal. Therefore, under these circumstances, **no adverse effect on the integrity of the Humber Estuary SAC** is predicted as a result of disturbance during construction of the Sizewell C in relation to the conservation objectives for grey seal. This remains unchanged from the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

Underwater noise during dredging

9.1.31 Additional dredging for the intake and outfall (diffuser) headworks would generate underwater noise.

9.1.32 As outlined in **Section** Error! Reference source not found., as a precautionary approach, it has been assumed that dredging prior to the installation for the desalination intake and outfalls would be undertaken employing the same method, volume and depth as the dredging for the FRR outfalls and the CDO. This is likely to be a conservative assumption as the diameter of the desalination plant intake and outfall are smaller than the FRR, therefore the dredge requirements are likely to be less.

9.1.33 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), underwater noise modelling for dredging activities associated with the FRR and CDO headworks assumed dredging would last for 9.5 hours and applied precautionary source levels from a large trailing suction hopper dredger. The potential effects of underwater noise from dredging activities for the desalination plant intakes and outfall headworks would be within the envelope of previous modelling.

9.1.34 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), noise levels from dredging are too low to generate instantaneous auditory effect for marine mammals, including grey seal. The underwater noise modelling for dredging associated with the FRRs, using predicted cumulative sound exposure effects for stationary scenarios (i.e. animal remains close to the noise source for 24 hours), was 0.05km (0.01km^2) for permanent shift in hearing sensitivity (PTS) and 1.4km (2.99km^2) for temporary shift in hearing sensitivity (TTS) in grey seal. However, based on the more realistic fleeing cumulative exposure scenarios (i.e. animal swims away from the noise source at a constant speed), there were no PTS or TTS impact zones for seals.

9.1.35 Based on the unlikely scenario that grey seal remain in close proximity to the dredging noise source for 24 hours, the number of individuals that could potential be at risk of PTS from cumulative exposure (0.01km^2) is 0.0004 grey seal (based on worst-case density estimate used in **Shadow HRA Report** [APP-145] of 0.038 grey seal per km^2), this represents:

- up to 0.000005% of the previous South-East England Management Unit reference population of 8,716 grey seal (or up to 0.000006% of the previous estimated Humber Estuary SAC population of 6,526 grey seal based on the count at the Donna Nook haul-out site).
- up to 0.000005% of the updated South-East England Management Unit reference population of 8,667 grey seal (or up to 0.000008% of

the updated estimated Humber Estuary SAC population of 5,265 grey seal based on the latest count at the Donna Nook haul-out site).

9.1.36 Based on the unlikely scenario that grey seal remain in close proximity to the dredging noise source for 24 hours, the number of individuals that could potential be at risk of TTS from cumulative exposure (2.99km^2) is 0.1 grey seal, this represents:

- up to 0.001% of the previous South-East England Management Unit reference population of 8,716 grey seal (or up to 0.002% of the previous estimated Humber Estuary SAC population of 6,526 grey seal based on the count at the Donna Nook haul-out site).
- up to 0.001% of the updated South-East England Management Unit reference population of 8,667 grey seal (or up to 0.002% of the updated estimated Humber Estuary SAC population of 5,265 grey seal based on the latest count at the Donna Nook haul-out site).

9.1.37 There are currently no agreed thresholds for modelling disturbance of marine mammals from underwater noise. Therefore, for grey seal, a fleeing response is assumed to be the same as for TTS.

9.1.38 Therefore, due to the very small number of grey seal and very low percentage of the SAC population that could be affected, **no adverse effects on the integrity of the Humber Estuary SAC** are predicted due to any direct effects of underwater noise during dredging for the desalination plant in relation to the conservation objectives for grey seal.

9.1.39 As summarised in **Section** Error! Reference source not found., behavioural effects in fish from dredging are predicted to have maximum impact ranges of approximately 2.3km (6.7km^2) for sensitive fish species. As a worst-case if it is assumed that grey seal could be displaced from this area, the number of grey seal that could potentially be affected is 0.3, this represents:

- up to 0.003% of the previous South-East England Management Unit reference population of 8,716 grey seal (or up to 0.005% of the previous estimated Humber Estuary SAC population of 6,526 grey seal based on the count at the Donna Nook haul-out site).
- up to 0.004% of the updated South-East England Management Unit reference population of 8,667 grey seal (or up to 0.006% of the updated estimated Humber Estuary SAC population of 5,265 grey seal based on the latest count at the Donna Nook haul-out site).

9.1.40 Dredging for the installation of the desalination headworks would be short-term discrete events. Where fish have experienced minor disturbances and

moved away from dredging, it is anticipated they would return to the area in a matter of hours to days.

9.1.41 Grey seal have large foraging ranges and any highly localised prey displacement would not have a significant effect on grey seal foraging in the area.

9.1.42 Therefore, due to the very small number of grey seal and very low percentage of the SAC population that could be affected, **no adverse effects on the integrity of the Humber Estuary SAC** are predicted due to any indirect effects of underwater noise during dredging for the desalination plant in relation to the conservation objectives for grey seal.

9.1.43 The individual dredge events would be short in duration and at individual scales with limited, localised impacts, and would not interact.

9.1.44 Any disturbance of grey seal, directly or indirectly, from underwater noise during dredging for the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above. Therefore, there would be no additional disturbance effects from the dredging for the desalination plant compared to the worst-cases previously assessed for the Sizewell C Project and the outcomes of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178] remain unchanged and there would be no adverse effects on site integrity.

Underwater noise during removal

9.1.45 Following use of the desalination plant in the construction phase, the headworks would be removed. During removal of the intake heads connecting pipework would need to be cut. As a worst case for underwater noise water jet cutting is assessed.

9.1.46 The effects of water jet cutting have been assessed for the decommissioning of the temporary BLF, based on worst-case assumptions and at the deepest point for greatest sound propagation, in the **Underwater Noise Report** (Doc Ref 9.58 [REP5-124]).

9.1.47 This modelling indicates that noise levels during cutting will be too low to generate instantaneous auditory effect zones for marine mammals.

9.1.48 For the assessments for cumulative exposure, the modelling assumed a fleeing behaviour (i.e. that marine mammals would flee from the source location at the onset of activity). Cumulative sound exposure was based on a worst-case of removing two piles within 24 hours, with the maximum interval of one hour per pile.

9.1.49 The modelling indicates that the potential for PTS or TTS from cumulative exposure in seals is negligible (25m from source).

9.1.50 Impacts associated with removal of the heads are predicted to be less than those assessed for dredging. Any effects are predicted to be short-term and temporary and marine mammals would return to the area after activity ceases.

9.1.51 Therefore, **no adverse effects on the integrity of the Humber Estuary SAC** are predicted due to of underwater noise during removal of the desalination plant in relation to the conservation objectives for grey seal.

9.1.52 Any disturbance of grey seal, directly or indirectly, from underwater noise during removal of the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above. Therefore, there would be no additional disturbance effects from the removal of the desalination plant compared to the wort-cases previously assessed and the outcomes of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

iii. Direct habitat loss and direct / indirect habitat fragmentation

9.1.53 As outlined in **Section** Error! Reference source not found., the dredging volumes are expected to be the same as for the FRR assessment, with a maximum of an additional 0.0026km^2 of seabed impacted by dredging for the desalination plant headworks.

9.1.54 Due to the very small, localised area there will be no direct effects on foraging grey seal. The potential effects on any prey will be very low due to the limited spatial extent of dredging relative to the extent of the affected habitat (subtidal sand) in the GSB.

9.1.55 Any changes to habitats as a result of dredging (0.0026km^2) are within the maximum potential area for water quality effects during the dredging and the maximum potential areas of effects from underwater noise on grey seal and their prey during the dredging. Therefore, there would be no additional effects during dredging.

9.1.56 As outlined in the **Shadow HRA Addendum** [AS-178], the total area of long-term habitat loss and potential changes to the habitat is 0.026km^2 (including the enhance permanent BLF and temporary BLF). The addition of the dredge area for the desalination plant would result in an updated total of 0.0286km^2. This does not change the outcome of the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]).

9.1.57 **No adverse effects on the integrity of the Humber Estuary SAC** are predicted due to changes in habitat, including as a result of dredging for the desalination plant, in relation to the conservation objectives for grey seal.

iv. Physical interaction between species and project infrastructure

9.1.58 For marine mammals, the potential for any physical interaction between species and project infrastructure are:

- Increased collision risk with vessels.
- Entrainment of prey species.

9.1.59 As outlined in Natural England's written representation submitted at deadline 2 [REP2-153], Natural England have no further concerns regarding physical interaction between project infrastructure and marine mammals.

9.1.60 As outlined in **Section** Error! Reference source not found., there is no potential for impingement of prey species as a result of water intake to the desalination plant.

Entrainment of prey species

9.1.61 As assessed in the **Fourth ES Addendum** (Doc Ref. 6.18) and summarised in **Section** Error! Reference source not found., the larval stages of the fish key taxa Dover sole, flounder, herring, sprat and gobies may be entrained by the desalination water abstraction along with the eggs of Dover sole, sprat, anchovy and sea bass. However, the natural mortality of these early life history stages is very high.

9.1.62 The abstraction rate for the desalination plant during construction is less than the proposed Sizewell C cooling water abstraction once operational and will only occur for a number of years during the construction phase, with no temporal overlap with cooling water abstraction during operation of the power station.

9.1.63 Losses of Dover sole, flounder, herring, sprat, sea bass and anchovy, were assessed for the far greater impact of entrainment by the main cooling water flow (**Section 22.8d)iii)** within **Volume 2**, **Chapter 22** of the **ES** (Doc Ref. 6.3) [AS-035]) and the effects were predicted to be orders of magnitude below the 1% spawning stock biomass (SSB) threshold. For smaller species such as gobies, the smaller mesh size employed at the desalination intake would minimise adult and juvenile entrainment.

9.1.64 The low abstraction rate of the desalination plant, less than 0.09% of the main cooling water abstraction during peak freshwater demand during the

construction phase, and no overlap with the main cooling water flows would mean losses of larvae would be indiscernible relative to high rates of natural mortality. Therefore, entrainment is predicted to have negligible effects on fish populations. Any effects are not significant relative to high levels of natural variability.

9.1.65 The very small abstraction rates relative to tidal exchange in the open coastal environment would result in negligible losses in the availability of prey resources and the effects of any localised depletion would not be significant.

9.1.66 Therefore, **no adverse effects on the integrity of the Humber Estuary SAC** are predicted due to entrainment of prey species as a result of the water abstraction, including the abstraction by the desalination plant, in relation to the conservation objectives for grey seal.

Increased collision risk with vessels

9.1.67 During dredging and installation of the offshore infrastructure for the desalination plant, the number of vessels on site would increase.

9.1.68 The assessments in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) for potential for increased vessel collision risk were based on an area of 6.5km^2 (the marine area within the Order Limits). The dredge area (0.0026km^2) for the offshore infrastructure of the desalination plant is within this area. Therefore, there is no additional vessel collision risk compared to what was previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]).

9.1.69 The increased number of vessels would be very small and in a localised area. During dredging and installation of the offshore infrastructure for the desalination plant, vessels on site would be slow moving or stationary, reducing the risk of any collisions with marine mammals.

9.1.70 Vessels on approach to the proposed development would operate at lower speeds. For example, the **Code of Construction Practice** (**CoCP**) (Doc Ref. 8.11(D) [APP-615]) recommends site speed restrictions of <10 knots. Vessels travelling at high speeds are considered to be more likely to collide with marine mammals, and those travelling at speeds below 10 knots would rarely cause any serious injury (Ref. 9.2).

9.1.71 As such, there will be **no adverse effect on the integrity of the Humber Estuary SAC** from any potential for increased vessel collision risk to foraging grey seal, including the small increase in number of vessels associated with the dredging and installation of the offshore infrastructure for the desalination plant.

9.2 Updated assessment - Southern North Sea SAC

a) Harbour porpoise

i. Water quality effects – marine environment

9.2.1 As outlined in **Section** Error! Reference source not found., the potential water quality effects of the desalination plant on harbour porpoise from the Southern North Sea SAC and their prey would be:

- Changes in suspended sediments during dredging
- Increases in heavy metal concentrations

9.2.2 The changes in suspended sediment and any increases in heavy metal concentrations as a result of the desalination plant would not result in an increase to the maximum area over which changes in marine water quality (7.26km^2) could occur due to the Sizewell C Project, and which formed the basis of the assessment previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) (i.e. the effect would be within the assessed envelope).

9.2.3 As a precautionary approach, the number of harbour porpoise that potentially could be present (and percentage of the updated reference population (see **Section** Error! Reference source not found.)) within this the maximum area of 7.26km^2 for changes in water quality has been updated.

9.2.4 The total number of harbour porpoise that could be present in the maximum area of 7.26km^2 is 4.4 individuals (based on density estimate used in **Shadow HRA Report** [APP-145] of 0.607 per km^2), this represents:

- up to 0.001% of the previous North Sea Management Unit estimate of 345,373 harbour porpoise.
- up to 0.001% of the updated North Sea Management Unit estimate of 346,601 harbour porpoise.

9.2.5 In the context of the Southern North Sea SAC, the maximum area of any potential effect (7.26km^2) is approximately 0.06% of the SAC winter area (which has an area of 12,696km^2). If it is assumed as a worst-case that changes to water quality could occur throughout the duration of the winter season (a total of 182 days), the maximum seasonal average would be 0.06%. Displacement of harbour porpoise, therefore, would not exceed either the 20% threshold of effect at any one time or exceed the 10% seasonal component of the SAC on average over the season.

9.2.6 Therefore, **no adverse effects on the integrity of the Southern North Sea SAC** are predicted due to changes in water quality in relation to the conservation objectives for harbour porpoise.

Increased suspended sediment concentrations

9.2.7 Whilst there could be some increase in suspended sediment concentrations, the plume would be transitory, short-term in nature and within natural variation and the maximum area previously assessed.

9.2.8 As outlined in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]), increased turbidity as a result of dredging will not have a direct effect on harbour porpoise. Harbour porpoise often inhabit naturally turbid or dark environments. This is likely because other senses are utilised, and vision is not solely relied upon.

9.2.9 Harbour porpoise have large foraging ranges and any highly localised prey displacement would not have a significant effect on any harbour porpoise in the area.

9.2.10 Therefore, **no adverse effects on the integrity of the Southern North Sea SAC** are predicted due to increased suspended sediment, including as a result of the dredging for the desalination plant, in relation to the conservation objectives for harbour porpoise.

Increases in heavy metal concentrations

9.2.11 As summarised in **Section** Error! Reference source not found., the maximum area affected by increased heavy metal concentrations in the desalination discharge is precautionarily estimated to be less than 0.005km^2. As outlined above, this would not result in an increase to the maximum area over which changes in marine water quality (7.26km^2) could occur due to the Sizewell C Project, and which formed the basis of the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) (i.e. the effect would be within the assessed envelope).

9.2.12 Although the spatial area of exposure is small, the duration of the discharge is potentially several years, throughout the construction period.

9.2.13 Therefore, as a precautionary approach it is assumed that harbour porpoise and their prey could be displaced from this area (0.005km^2) as a result of increased heavy metal concentrations in the brine discharge from the desalination plant.

9.2.14 This is very precautionary as modelling of the worst-case discharge plume, using the maximum 10Ml per day (6Ml per day discharge) scenario, indicates the maximum area, calculated based on the tidal ellipse, above

EQS (or detectable above background concentrations) is 0.0008km^2 for chromium (as detailed in **Appendix 3.A** of the **Fourth ES Addendum** (Doc Ref. 6.18)).

9.2.15 The total number of harbour porpoise that could be present in the maximum area of 0.005km^2 is 0.003 individuals (based on density estimate used in **Shadow HRA Report** [APP-145] of 0.607 per km^2), this represents:

- up to 0.0000009% of the previous North Sea Management Unit estimate of 345,373 harbour porpoise.
- up to 0.0000009% of the updated North Sea Management Unit estimate of 346,601 harbour porpoise.

9.2.16 In the context of the Southern North Sea SAC, the maximum area of any potential effect (0.005km^2) is approximately 0.00004% of the SAC winter area (which has an area of 12,696km^2). If it is assumed as a worst-case that changes to water quality could occur throughout the duration of the winter season (a total of 182 days), the maximum seasonal average would be 0.00004%. Displacement of harbour porpoise, therefore, would not exceed either the 20% threshold of effect at any one time or exceed the 10% seasonal component of the SAC on average over the season.

9.2.17 As outlined in **Section** Error! Reference source not found., the impact of chromium, lead and zinc exposure resulting from construction discharges, is predicted to have a negligible effect on fish. Any potential effects on fish are not significant at the sea area and regional stock/population levels.

9.2.18 Any displacement behaviour of fish due to discharges of heavy metals is predicted to be highly localised and exposure would represent a negligibly small proportion of fish in the GSB. Therefore, no significant changes in the availability as prey for harbour porpoise are predicted.

9.2.19 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), the limited spatial extent of zinc, lead and chromium discharges in the inshore waters mean the probability of exposure is minimal, especially as that uptake is only possible indirectly through the consumption of prey. In fish, the direct uptake of heavy metals occurs through the gills, and there is a potential for indirect effects through food webs. However, the fish assessment predicts negligible effects of chromium, lead and zinc exposure on fish species due to minimal spatial exposure. No significant indirect effects through their prey are expected in marine mammals.

9.2.20 Harbour porpoise have large foraging ranges and any highly localised prey displacement would not have a significant effect on harbour porpoise foraging in the area.

9.2.21 The increases in heavy metal concentrations in the discharges from the desalination plant during construction will not occur at the same time or overlap with discharges during operation of Sizewell C.

9.2.22 Therefore, **no adverse effects on the integrity of the Southern North Sea SAC** are predicted due to water quality effects, including any increased heavy metal concentrations from construction discharges associated with the desalination plant, in relation to the conservation objectives for harbour porpoise.

ii. Disturbance effects on species populations

9.2.23 As outlined in **Section** Error! Reference source not found., the potential disturbance effects from underwater noise as a result of the desalination plant on harbour porpoise from the Southern North Sea SAC and their prey would be:

- Underwater noise during dredging.
- Underwater noise during removal.

9.2.24 Underwater noise and potential disturbance effects during dredging prior to installation of the offshore infrastructure for the desalination plant and removal of the offshore infrastructure for the desalination plant would occur in the construction phase of the Sizewell C Project.

9.2.25 The potential distance from underwater noise during dredging and removal of the offshore infrastructure for the desalination plant would remain within the worst-case for underwater noise disturbance during the construction phase as previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178]. These assessments have been updated to reflect recent changes in reference populations (see **Section** Error! Reference source not found.).

9.2.26 In the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]), the maximum predicted area of disturbance from impact piling during construction was based on worst-case disturbance range of up to 26km, an area of up to 967km^2 in the winter area for the Southern North Sea SAC which could affect up to 587 harbour porpoise (0.17% of the previous estimate for the North Sea Management Unit). This represents up to 0.17% of the updated North Sea Management Unit of 346,601 harbour porpoise, that could be affected.

9.2.27 A worst-case disturbance area of up to 967km^2 equates to 7.6% of the winter area (12,696km^2) of the Southern North Sea SAC.

9.2.28 In the first **Shadow HRA Addendum** [AS-178], the maximum predicted area of disturbance from impact piling during construction was based on the current SNCB guidance for assessing the significance of noise disturbance against conservation objectives of harbour porpoise SACs (Ref. 9.1). This guidance identifies noise generating activities that can potentially result in disturbance to harbour porpoise and provides recommended EDR for these activities. The recommended EDR for pin-piles is 15km (with or without mitigation; Ref. 9.1).

9.2.29 In the first **Shadow HRA Addendum** [AS-178], a precautionary disturbance area of up to up to 341.07km^2 in the winter area for the Southern North Sea SAC, based on a 15km EDR and worst-case pile location, was assessed. The number of harbour porpoise that could be disturbed is up to 207 (based on density estimate of 0.607 per km^2 as used in the Shadow HRA Report). This represents 0.06% of the previous North Sea Management Unit reference population of 345,373 harbour porpoise. This represents up to 0.06% of the updated North Sea Management Unit of 346,601 harbour porpoise that could be affected.

9.2.30 A disturbance area of up to 341.07km^2 equates to 2.7% of the winter area (12,696km^2) of the Southern North Sea SAC. This is below the spatial disturbance threshold of 20% of the seasonal component of the Southern North Sea SAC.

9.2.31 If it is assumed as a highly unlikely scenario that disturbance could be throughout the winter period (182 days), the seasonal average would be up to 2.7%. This is below the seasonal average threshold of 10% of the seasonal component of the Southern North Sea SAC.

9.2.32 Taking into account the temporary disturbance and intermittent duration of underwater noise during construction, **no adverse effect on the integrity of the Southern North Sea SAC** is predicted as a result of disturbance during construction of the Sizewell C in relation to the conservation objectives for harbour porpoise. This remains unchanged from the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.2.33 The potential in-combination disturbance effect on harbour porpoise in the Southern North Sea SAC winter area as a result of underwater noise due to the Sizewell C Project and other plans and projects is considered further in the draft Site Integrity Plan (SIP) (Appendix 9A of Document [AS-178]).

Underwater noise during dredging

9.2.34 Additional dredging for the intake and outfall (diffuser) headworks would generate underwater noise.

9.2.35 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), noise levels from dredging are too low to generate instantaneous auditory effect for marine mammals, including harbour porpoise.

9.2.36 The underwater noise modelling for dredging, predicted cumulative sound exposure effects for stationary scenarios (i.e. animal remains close to the noise source for 24 hours), was 0.8km permanent shift in hearing sensitivity (PTS) and approximately 6.5km for temporary shift in hearing sensitivity (TTS) in harbour porpoise. However, based on the more realistic fleeing cumulative exposure scenarios (i.e. animal swims away from the noise source at a constant speed), no PTS was predicted and the TTS impact range was 1km (approximately 3.14km^2) for harbour porpoise.

9.2.37 Based on the mostly likely fleeing cumulative exposure scenario, the number of individuals that could potential be at risk of TTS (3.14km^2) from cumulative exposure is 1.9 harbour porpoise (based on density estimate of 0.607 per km^2 as used in the Shadow HRA Report). This represents 0.0006% of the previous North Sea Management Unit reference population of 345,373 harbour porpoise. This represents up to 0.0006% of the updated North Sea Management Unit of 346,601 harbour porpoise that could be affected.

9.2.38 An area of up to 3.14km^2 equates to 0.025% of the winter area (12,696km^2) of the Southern North Sea SAC. This is below the spatial disturbance threshold of 20% of the seasonal component of the Southern North Sea SAC.

9.2.39 If it is assumed as a highly unlikely scenario that disturbance could be throughout the winter period (182 days), the seasonal average would be up to 0.025%. This is below the seasonal average threshold of 10% of the seasonal component of the Southern North Sea SAC.

9.2.40 Taking into account the temporary disturbance and intermittent duration of underwater noise during dredging, n**o adverse effect on the integrity of the Southern North Sea SAC** are predicted due to any direct effects of underwater noise during dredging for the desalination plant in relation to the conservation objectives for harbour porpoise.

9.2.41 As summarised in **Section** Error! Reference source not found., behavioural effects in fish from dredging are predicted to have maximum impact ranges of approximately 2.3km (6.7km^2) for sensitive fish species. As a worst-case if it is assumed that harbour porpoise could be displaced from this area, the number of harbour porpoise that could potentially be affected is 4. This represents 0.001% of the previous North Sea Management Unit reference population of 345,373 harbour porpoise. This represents up to 0.001% of

the updated North Sea Management Unit of 346,601 harbour porpoise that could be affected.

9.2.42 An area of up to 6.7km^2 equates to 0.05% of the winter area (12,696km^2) of the Southern North Sea SAC. This is below the spatial disturbance threshold of 20% of the seasonal component of the Southern North Sea SAC.

9.2.43 If it is assumed as a highly unlikely scenario that disturbance could be throughout the winter period (182 days), the seasonal average would be up to 0.05%. This is below the seasonal average threshold of 10% of the seasonal component of the Southern North Sea SAC.

9.2.44 Dredging for the installation of the desalination headworks would be short-term discrete events. Where fish have experienced minor disturbances and moved away from dredging, it is anticipated they would return to the area in a matter of hours to days.

9.2.45 Harbour porpoise have large foraging ranges and any highly localised prey displacement would not have a significant effect on harbour porpoise foraging in the area.

9.2.46 Therefore, **no adverse effect on the integrity of the Southern North Sea SAC** are predicted due to any indirect effects of underwater noise during dredging, including for the desalination plant, in relation to the conservation objectives for harbour porpoise.

9.2.47 Any disturbance of harbour porpoise, directly or indirectly, from underwater noise during dredging for the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above. Therefore, there would be no additional disturbance effects from the dredging compared to the wort-cases previously assessed and the outcomes of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

Underwater noise during removal

9.2.48 Following use of the desalination plant in the construction phase, the headworks would be removed. During removal of the intake heads connecting pipework would need to be cut. As a worst case for underwater noise water jet cutting is assessed.

9.2.49 The effects of water jet cutting have been assessed for the decommissioning of the temporary BLF, based on worst-case assumptions and at the deepest point for greatest sound propagation, in the **Underwater Noise Report** (Doc Ref 9.58 [REP5-124]).

9.2.50 This modelling indicates that noise levels during cutting will be too low to generate instantaneous auditory effect zones for marine mammals, including harbour porpoise.

9.2.51 The modelling indicates that the potential for PTS in harbour porpoise from cumulative exposure is negligible (25m from source).

9.2.52 The potential for TTS in harbour porpoise from cumulative exposure is approximately 0.02km^2.

9.2.53 The number of harbour porpoise that could potentially be affected in an area of 0.02km^2 is 0.01. This represents 0.000003% of the previous North Sea Management Unit reference population of 345,373 harbour porpoise. This represents up to 0.000003% of the updated North Sea Management Unit of 346,601 harbour porpoise that could be affected.

9.2.54 An area of up to 0.02km^2 equates to 0.0002% of the winter area (12,696km^2) of the Southern North Sea SAC. This is below the spatial disturbance threshold of 20% of the seasonal component of the Southern North Sea SAC.

9.2.55 Impacts associated with removal of the heads are predicted to be less than those assessed for dredging. Any effects are predicted to be short-term and temporary and marine mammals would return to the area after activity ceases.

9.2.56 Therefore, **no adverse effect on the integrity of the Southern North Sea SAC** is predicted due to of underwater noise during removal of the desalination plant in relation to the conservation objectives for harbour porpoise.

9.2.57 Any disturbance of harbour porpoise, directly or indirectly, from underwater noise during removal of the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above. Therefore, there would be no additional disturbance effects from the removal of the desalination plant compared to the wort-cases previously assessed and the outcomes of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

iii. Direct habitat loss and direct / indirect habitat fragmentation

9.2.58 The dredging area for the desalination plant is located in the winter area of the Southern North Sea.

9.2.59 As outlined in **Section** Error! Reference source not found., the dredging volumes are expected to be the same as for the FRR assessment, with a

maximum of an additional 0.0026km^2 of seabed impacted by dredging for the desalination plant headworks.

9.2.60 The total number of harbour porpoise that could be present in the maximum dredge area of 0.0026km^2 is 0.002 individuals (based on density estimate used in **Shadow HRA Report** [APP-145] of 0.607 per km^2), this represents:

- up to 0.0000006% of the previous North Sea Management Unit estimate of 345,373 harbour porpoise.
- up to 0.0000006% of the updated North Sea Management Unit estimate of 346,601 harbour porpoise.

9.2.61 In the context of the Southern North Sea SAC, the maximum area of any potential effect (0.0026km^2) is approximately 0.00002% of the SAC winter area (which has an area of 12,696km^2). If it is assumed as a worst-case that habitat changes could occur throughout the duration of the winter season (a total of 182 days), the maximum seasonal average would be 0.00002%. Displacement of harbour porpoise, therefore, would not exceed either the 20% threshold of effect at any one time or exceed the 10% seasonal component of the SAC on average over the season.

9.2.62 The potential effects on habitats as a result of dredging would be short in duration and at individual scales with limited, localised impacts.

9.2.63 As outlined in **Section** Error! Reference source not found., the potential effects on prey are very low due to the limited spatial extent of dredging relative to the extent of the affected habitat (subtidal sand) in the GSB.

9.2.64 Any changes to habitats as a result of dredging (0.0026km^2) are within the maximum potential area for water quality effects during the dredging and the maximum potential areas of effects from underwater noise on harbour porpoise and their prey during the dredging. Therefore, there would be no additional effects during dredging.

9.2.65 **No adverse effect on the integrity of the Southern North Sea SAC** are predicted due to changes in habitat as a result of dredging, including dredging for the desalination plant, in relation to the conservation objectives for harbour porpoise.

9.2.66 The dredging for the desalination plant would occur during the construction phase of the Sizewell C Project. Other potential areas of habitat loss or habitat changes during construction are installation of the intake and outfall tunnels, the BLF and associated infrastructure, the FRR and CDO structures, including areas of scour (or scour protections), and dredging the navigation channel.

9.2.67 As outlined in the first **Shadow HRA Addendum** [AS-178], the total area of long-term habitat loss and potential changes to the habitat is 0.026km^2 (including the enhance permanent BLF and temporary BLF). The addition of the dredge area for the desalination plant would result in an updated total of 0.0286km^2. This equates to 0.0002% of the winter area of the Southern North Sea SAC (12,696km^2), the same as assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and below the spatial disturbance threshold of 20% and the seasonal average displacement threshold of 10% of the seasonal component. Consequently, **no adverse effect on the integrity of the Southern North Sea SAC** is predicted due to habitat loss associated with the Sizewell C Project in relation to the conservation objectives for harbour porpoise.

iv. Physical interaction between species and project infrastructure

9.2.68 For marine mammals, the potential for any physical interaction between species and project infrastructure are:

- Increased collision risk with vessels
- Entrainment of prey species

9.2.69 As outlined in **Section** Error! Reference source not found., there is no potential for impingement of prey species as a result of water intake to the desalination plant.

Entrainment of prey species

9.2.70 As assessed in the **Fourth ES Addendum** (Doc Ref. 6.18) and summarised in **Section** Error! Reference source not found., the larval stages of the fish key taxa Dover sole, flounder, herring, sprat and gobies may be entrained by the desalination water abstraction along with the eggs of Dover sole, sprat, anchovy and sea bass. However, the natural mortality of these early life history stages is very high.

9.2.71 The abstraction rate for the desalination plant during construction is less than the proposed cooling water abstraction once operational and will only occur for a number of years during the construction phase, with no temporal overlap with cooling water abstraction during operation.

9.2.72 Losses of Dover sole, flounder, herring, sprat, sea bass and anchovy, were assessed for the far greater impact of entrainment by the main cooling water flow (**Section 22.8d)iii)** within **Volume 2**, **Chapter 22** of the **ES** (Doc Ref. 6.3) [AS-035]) and the effects were predicted to be orders of magnitude below the 1% spawning stock biomass SSB threshold. For smaller species

such as gobies, the smaller mesh size employed at the desalination intake would minimise adult and juvenile entrainment.

9.2.73 The low abstraction rate of the desalination plant, which would be less than 0.09% of the main operational cooling water abstraction, during peak freshwater demand during the construction phase, with no temporal overlap with the main cooling water flows would mean losses of larvae would be indiscernible relative to high rates of natural mortality. Therefore, entrainment is predicted to have negligible effects on fish populations. Any effects are not significant relative to high levels of natural variability.

9.2.74 The very small abstraction rates relative to tidal exchange in the open coastal environment would result in negligible losses in the availability of prey resources and the effects of any localised depletion would not be significant.

9.2.75 Therefore, **no adverse effect on the integrity of the Southern North Sea SAC** are predicted due to entrainment of prey species as a result of the water abstraction for the desalination plant in relation to the conservation objectives for harbour porpoise.

Increased collision risk with vessels

9.2.76 During dredging and installation of the offshore infrastructure for the desalination plant, the number of vessels on site would increase.

9.2.77 The assessments in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) for potential for increased vessel collision risk were based on an area of 6.5km^2 (the marine area within the Order Limits). The dredge area (0.0026km^2) for the offshore infrastructure of the desalination plant is within this area. There would only be a small number of vessels, stationary or slow moving in a localised area. Therefore, there is no additional vessel collision risk compared to that previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]).

9.2.78 During dredging and installation of the offshore infrastructure for the desalination plant, vessels on site would be slow moving or stationary, reducing the risk of any collisions with marine mammals.

9.2.79 Vessels on approach to the proposed development would operate at lower speeds. For example, the **Code of Construction Practice** (**CoCP**) (Doc Ref. 8.11(A) [APP-615]) recommends site speed restrictions of <10 knots. Vessels travelling at high speeds are considered to be more likely to collide with marine mammals, and those travelling at speeds below 10 knots would rarely cause any serious injury (Ref. 9.2).

9.2.80 As such, there will be **no adverse effect on the integrity of the Southern North Sea SAC** from any potential for increased vessel collision risk to harbour porpoise, including as a result of the dredging and installation of the offshore infrastructure for the desalination plant.

9.3 Updated assessment - The Wash and North Norfolk Coast SAC

a) Harbour seal

i. Water quality effects – marine environment

9.3.1 As outlined in **Section** Error! Reference source not found., the potential water quality effects of the desalination plant on foraging harbour seal from The Wash and North Norfolk Coast SAC and their prey would be:

- Changes in suspended sediments during dredging
- Increases in heavy metal concentrations

9.3.2 The changes in suspended sediment and increases in heavy metal concentrations as a result of the desalination plant would as outlined below, not result in an increase to the maximum area over which changes in marine water quality (7.26km^2) could occur due to the Sizewell C Project, and which formed the basis of the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) (i.e. the effect would be within the assessed envelope).

9.3.3 As a precautionary approach, the number of harbour seal that potentially could be present (and percentage of the updated reference population (see **Section** Error! Reference source not found.)) within this the maximum area (7.26km^2) for changes in water quality has been updated.

9.3.4 The total number of foraging harbour seal that could be present in the maximum area of 7.26km^2 is 0.3 individuals (based on worst-case density estimate used in **Shadow HRA Report** [APP-145] of 0.039 harbour seal per km^2, this represents:

- up to 0.006% of the previous South-East England Management Unit reference population of 4,965 harbour seal (or up to 0.008% of the previous estimated Wash and North Norfolk Coast SAC population of 3,609 harbour seal based on the counts at the Wash and Blakeney Point haul-out sites).
- up to 0.008% of the updated South-East England Management Unit reference population of 3,752 harbour seal (or up to 0.01% of the updated estimated Wash and North Norfolk Coast SAC population of

2,744 harbour seal based on the latest count at the Wash and Blakeney Point haul-out sites).

9.3.5 Therefore, given the very low number of harbour seal and low percentage of the SAC population, **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to changes in water quality in relation to the conservation objectives for harbour seal.

Increased suspended sediment concentrations

9.3.6 Whilst there could be some increase in suspended sediment concentrations, the plume would be transitory, short-term in nature and within natural variation and the maximum area previously assessed.

9.3.7 As outlined in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]), increased turbidity as a result of dredging will not have a direct effect on foraging harbour seal as they are not dependent on vision to forage. Harbour seal are well adapted to existence in turbid coastal waters.

9.3.8 Harbour seal have large foraging ranges and any highly localised prey displacement would not have a significant effect on harbour seal foraging in the area.

9.3.9 Therefore, **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to increased suspended sediment, including as a result of the dredging for the desalination plant in relation to the conservation objectives for harbour seal.

Increases in heavy metal concentrations

9.3.10 As summarised in **Section** Error! Reference source not found., the maximum area affected by substances in the desalination discharge would be precautionarily estimated as less than 0.005km^2. This is within the maximum envelope for changes in water quality (7.26km^2) predicted for the Sizewell C Project as previously assessed in the Shadow HRA Report (Doc Ref. 5.10 [APP-145]).

9.3.11 Although the spatial area of exposure is small, the duration of the discharge is potentially several years, throughout the construction period.

9.3.12 Therefore, as a precautionary approach it is assumed that harbour seal and their prey could be displaced from this area (0.005km^2) as a result of increased heavy metal concentrations in the brine discharge from the desalination plant.

9.3.13 This is very precautionary as modelling of the worst-case discharge plume, using the maximum 10Ml per day (6Ml per day discharge) scenario,

indicates the maximum area, calculated based on the tidal ellipse, above EQS (or detectable above background concentrations) is 0.0008km^2 for chromium (as detailed in **Appendix 3.A** of the **Fourth ES Addendum** (Doc Ref. 6.18)).

9.3.14 The total number of foraging harbour seal that could be present in the maximum area of 0.005km^2 is 0.0002 individuals (based on worst-case density estimate used in **Shadow HRA Report** [APP-145] of 0.039 harbour seal per km^2), this represents:

- up to 0.000004% of the previous South-East England Management Unit reference population of 4,965 harbour seal (or up to 0.000006% of the previous estimated Wash and North Norfolk Coast SAC population of 3,609 harbour seal based on the counts at the Wash and Blakeney Point haul-out sites).

- up to 0.000005% of the updated South-East England Management Unit reference population of 3,752 harbour seal (or up to 0.000007% of the updated estimated Wash and North Norfolk Coast SAC population of 2,744 harbour seal based on the latest count at the Wash and Blakeney Point haul-out sites).

9.3.15 As outlined in **Section** Error! Reference source not found., the impact of chromium, lead and zinc exposure resulting from construction discharges, is predicted to have a negligible effect on fish. Any potential effects on fish are not significant at the sea area and regional stock/population levels.

9.3.16 Any displacement behaviour of fish due to discharges of heavy metals is predicted to be highly localised and exposure would represent a negligibly small proportion of fish in the GSB. Therefore, no significant changes in the availability as prey for foraging harbour seal are predicted.

9.3.17 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), the limited spatial extent of zinc, lead and chromium discharges in the inshore waters means the probability of exposure is minimal, especially as that uptake is only possible indirectly through the consumption of prey. In fish, the direct uptake of heavy metals occurs through the gills, and there is a potential for indirect effects through food webs. However, the fish assessment predicts negligible effects of chromium, lead and zinc exposure on fish species due to minimal spatial exposure. No significant indirect effects through their prey are expected in marine mammals.

9.3.18 Harbour seal have large foraging ranges and any highly localised prey displacement would not have a significant effect on harbour seal foraging in the area.

9.3.19 The increases in heavy metal concentrations in the discharges from the desalination plant during construction will not occur at the same time or overlap with discharges during the operation of Sizewell C.

9.3.20 Therefore, **no adverse effects on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to water quality effects, including any increased heavy metal concentrations from construction discharges associated with the desalination plant, in relation to the conservation objectives for harbour seal.

ii. Disturbance effects on species populations

9.3.21 As outlined in **Section** Error! Reference source not found., the potential disturbance effects from underwater noise as a result of the desalination plant on harbour seal from The Wash and North Norfolk Coast SAC and their prey would be:

- Underwater noise during dredging.
- Underwater noise during removal.

9.3.22 Underwater noise and potential disturbance effects during dredging prior to installation of the offshore infrastructure for the desalination plant and removal of the offshore infrastructure for the desalination plant would occur in the construction phase of the Sizewell C Project.

9.3.23 The potential distance from underwater noise during dredging and removal of the offshore infrastructure for the desalination plant would within the worst-case for underwater noise disturbance during the construction phase as previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178]. These assessments have been updated to reflect recent changes in reference populations (see **Section** Error! Reference source not found.).

9.3.24 In the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]), the maximum predicted area of disturbance from impact piling during construction was based on worst-case disturbance range of up to 26km, an area of up to 1,100.66km^2, which could affect up to 43 harbour seal (0.87% of the previous South-East England Management Unit reference population; 1.19% of the previous Wash and Blakeney Point counts).

9.3.25 Based on the updated reference population, as outlined in **Section** Error! Reference source not found., up to 43 harbour seal, representing 1.15% of the updated South-East England Management Unit reference population of 3,752 harbour seal (or up to 1.57% of the updated estimated The Wash and North Norfolk Coast SAC population of 2,744 harbour seal, based on the

latest counts at the Wash and Blakeney Point haul-out sites), could be affected.

9.3.26 In the first **Shadow HRA Addendum** [AS-178], a precautionary disturbance area of up to up to 456.33km^2, based on a 15km EDR and worst-case pile location, was assessed for harbour seal, although recommended for harbour porpoise SAC. The number of harbour seal that could be disturbed is up to 17.8. This represents 0.36% of the previous South-East England Management Unit reference population (or 0.36% of the previous Wash and Blakeney Point counts).

9.3.27 Based on the updated reference population, as outlined in **Section** Error! Reference source not found., up to 17.8 harbour seal, representing 0.47% of the updated South-East England Management Unit reference population of 3,752 harbour seal (or up to 0.65% of the updated estimated The Wash and North Norfolk Coast SAC population of 2,744 harbour seal based on the latest counts at the Wash and Blakeney Point haul-out sites), could be affected.

9.3.28 It is highly unlikely that all foraging harbour seal that could be disturbed as result of underwater noise during construction would be from The Wash and North Norfolk Coast SAC. There would be no direct effect or overlap with the SAC.

9.3.29 Taking into account the temporary disturbance and intermittent duration of underwater noise during construction, **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** is predicted as a result of disturbance during construction of the Sizewell C in relation to the conservation objectives for harbour seal. This remains unchanged from the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

Underwater noise during dredging

9.3.30 Additional dredging for the intake and outfall (diffuser) headworks would generate underwater noise.

9.3.31 As outlined in the **Fourth ES Addendum** (Doc Ref. 6.18), noise levels from dredging are too low to generate instantaneous auditory effect for marine mammals, including harbour seal. The underwater noise modelling for dredging associated with the FRRs, predicted cumulative sound exposure effects for stationary scenarios (i.e. animal remains close to the noise source for 24 hours), was 0.05km (0.01km^2) permanent shift in hearing sensitivity (PTS) and 1.4km (2.99km^2) for temporary shift in hearing sensitivity (TTS) in harbour seal. However, based on the more realistic fleeing cumulative exposure scenarios (i.e. animal swims away from the

noise source at a constant speed), there were no PTS or TTS impact zones for seals.

9.3.32 Based on the unlikely scenario that harbour seal remain in close proximity to the dredging noise source for 24 hours, the number of individuals that could potential be at risk of PTS from cumulative exposure (0.01km^2) is 0.0004 harbour seal (based on worst-case density estimate used in **Shadow HRA Report** [APP-145] of 0.039 harbour seal per km^2), this represents:

- up to 0.000008% of the previous South-East England Management Unit reference population of 4,965 harbour seal (or up to 0.00001% of the previous estimated Wash and North Norfolk Coast SAC population of 3,609 harbour seal, based on the counts at the Wash and Blakeney Point haul-out sites).
- up to 0.00001% of the updated South-East England Management Unit reference population of 3,752 harbour seal (or up to 0.000015% of the updated estimated Wash and North Norfolk Coast SAC population of 2,744 harbour seal, based on the latest count at the Wash and Blakeney Point haul-out sites).

9.3.33 Based on the unlikely scenario that harbour seal remain in close proximity to the dredging noise source for 24 hours, the number of individuals that could potential be at risk of TTS from cumulative exposure (2.99km^2) is 0.1 harbour seal, this represents:

- up to 0.002% of the previous South-East England Management Unit reference population (or up to 0.003% of the previous estimated Wash and North Norfolk Coast SAC, based on the counts at the Wash and Blakeney Point haul-out sites).
- up to 0.003% of the updated South-East England Management Unit reference population (or up to 0.004% of the updated estimated Wash and North Norfolk Coast SAC, based on the latest count at the Wash and Blakeney Point haul-out sites).

9.3.34 There are currently no agreed thresholds for modelling disturbance of marine mammals from underwater noise. Therefore, for harbour seal, a fleeing response is assumed to be the same as for TTS.

9.3.35 Therefore, due to the very small number of grey seal and very low percentage of the SAC population that could be affected, **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to any direct effects of underwater noise, including during

dredging for the desalination plant, in relation to the conservation objectives for harbour seal.

9.3.36 As summarised in **Section** Error! Reference source not found., behavioural effects in fish from dredging are predicted to have maximum impact ranges of approximately 2.3km (6.7km^2) for sensitive fish species. As a worst-case if it is assumed that harbour seal could be displaced from this area, the number of harbour seal that could potentially be affected is 0.3, this represents:

- up to 0.006% of the previous South-East England Management Unit reference population (or up to 0.008% of the previous estimated Wash and North Norfolk Coast SAC, based on the counts at the Wash and Blakeney Point haul-out sites).
- up to 0.008% of the updated South-East England Management Unit reference population (or up to 0.01% of the updated estimated Wash and North Norfolk Coast SAC, based on the latest count at the Wash and Blakeney Point haul-out sites).

9.3.37 Dredging for the installation of the desalination headworks would be short-term discrete events. Where fish have experienced minor disturbances and moved away from dredging, it is anticipated they would return to the area in a matter of hours to days.

9.3.38 Harbour seal have large foraging ranges and any highly localised prey displacement would not have a significant effect on harbour seal foraging in the area.

9.3.39 Therefore, **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to any indirect effects of underwater noise during dredging for the desalination plant in relation to the conservation objectives for harbour seal.

9.3.40 The individual dredge events would be short in duration and at individual scales with limited, localised impacts, and would not interact.

9.3.41 Any disturbance of harbour seal, directly or indirectly, from underwater noise during dredging for the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above. Therefore, there would be no additional disturbance effects from the dredging compared to the worst-cases previously assessed and the outcomes of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178] and no adverse effect on the integrity of the site.

Underwater noise during removal

9.3.42 Following use of the desalination plant in the construction phase, the headworks would be removed. During removal of the intake heads connecting pipework would need to be cut. As a worst case for underwater noise water jet cutting is assessed.

9.3.43 The effects of water jet cutting have been assessed for the decommissioning of the temporary Beach Landing Facility (BLF), based on worst-case assumptions and at the deepest point for greatest sound propagation, in the **Underwater Noise Report** (Doc Ref 9.58 [REP5-124]).

9.3.44 This modelling indicates that noise levels during cutting will be too low to generate instantaneous auditory effect zones for marine mammals.

9.3.45 The modelling indicates that the potential for PTS or TTS from cumulative exposure in seals is negligible (25m from source).

9.3.46 Impacts associated with removal of the heads are predicted to be less than those assessed for dredging. Any effects are predicted to be short-term and temporary and marine mammals would return to the area after activity ceases.

9.3.47 Therefore, **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to of underwater noise during removal of the desalination plant in relation to the conservation objectives for harbour seal.

9.3.48 Any disturbance of harbour seal, directly or indirectly, from underwater noise during removal of the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above. Therefore, there would be no additional disturbance effects from the removal of the desalination plant compared to the worst-cases previously assessed and the outcomes of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178] and no adverse effect on the integrity of the site.

iii. Direct habitat loss and direct / indirect habitat fragmentation

9.3.49 As outlined in **Section** Error! Reference source not found., the dredging volumes are expected to be the same as for the FRR assessment, with a maximum of an additional 0.0026km^2 of seabed impacted by dredging for the desalination plant headworks.

9.3.50 Due to the very small, localised area there will be no direct effects on foraging harbour seal. The potential effects on any prey will be very low

due to the limited spatial extent of dredging relative to the extent of the affected habitat (subtidal sand) in the GSB.

9.3.51 Any changes to habitats as a result of dredging (0.0026km^2) are within the maximum potential area for water quality effects during the dredging and the maximum potential areas of effects from underwater noise on harbour seal and their prey during the dredging. Therefore, there would be no additional effects during dredging.

9.3.52 As outlined in the first **Shadow HRA Addendum** [AS-178], the total area of long-term habitat loss and potential changes to the habitat is 0.026km^2 (including the enhance permanent BLF and temporary BLF). The addition of the dredge area for the desalination plant would result in an updated total of 0.0286km^2. This does not change the outcome of the assessment in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]).

9.3.53 **No adverse effect on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to changes in habitat, including as a result of dredging for the desalination plant, in relation to the conservation objectives for harbour seal.

iv. Physical interaction between species and project infrastructure

9.3.54 For marine mammals, the potential for any physical interaction between species and project infrastructure are:

- Increased collision risk with vessels.
- Entrainment of prey species.

9.3.55 As outlined in **Section** Error! Reference source not found., there is no potential for impingement of prey species as a result of water intake to the desalination plant.

Entrainment of prey species

9.3.56 As assessed in the **Fourth ES Addendum** (Doc Ref. 6.18) and summarised in **Section** Error! Reference source not found., the larval stages of the fish key taxa Dover sole, flounder, herring, sprat and gobies may be entrained by the desalination water abstraction along with the eggs of Dover sole, sprat, anchovy and sea bass. However, the natural mortality of these early life history stages is very high.

9.3.57 The abstraction rate for the desalination plant during construction is less than the proposed cooling water abstraction once Sizewell C is operational and will only occur for a number of years during the construction phase, with no temporal overlap with cooling water abstraction during operation.

9.3.58 Losses of Dover sole, flounder, herring, sprat, sea bass and anchovy, were assessed for the far greater impact of entrainment by the main cooling water flow (**Section 22.8d)iii)** within **Volume 2**, **Chapter 22** of the **ES** (Doc Ref. 6.3) [AS-035]) and the effects were predicted to be orders of magnitude below the 1% spawning stock biomass SSB threshold. For smaller species such as gobies, the smaller mesh size employed at the desalination intake would minimise adult and juvenile entrainment.

9.3.59 The low abstraction rate of the desalination plant, less than 0.09% of the main Sizewell C operational cooling water abstraction, during peak freshwater demand during the construction phase, and no overlap with the main operational cooling water flows would mean losses of larvae would be indiscernible relative to high rates of natural mortality. Therefore, entrainment is predicted to have negligible effects on fish populations. Any effects are not significant relative to high levels of natural variability.

9.3.60 The very small abstraction rates relative to tidal exchange in the open coastal environment would result in negligible losses in the availability of prey resources and the effects of any localised depletion would not be significant.

9.3.61 Therefore, **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** are predicted due to entrainment or impingement of prey species as a result of the water abstraction, including requirements for the desalination plant, in relation to the conservation objectives for harbour seal.

Increased collision risk with vessels

9.3.62 During dredging and installation of the offshore infrastructure for the desalination plant, the number of vessels on site would increase.

9.3.63 The assessments in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) for potential for increased vessel collision risk were based on an area of 6.5km^2 (the marine area within the Order Limits). The dredge area (0.0026km^2) for the offshore infrastructure of the desalination plant is within this area. There would only be a small number of vessels, stationary or slow moving in a localised area. Therefore, there is no additional vessel collision risk compared to what was previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]).

9.3.64 During dredging and installation of the offshore infrastructure for the desalination plant, vessels on site would be slow moving or stationary, reducing the risk of any collisions with marine mammals.

9.3.65 Vessels on approach to the proposed development would operate at lower speeds. For example, the **Code of Construction Practice** (**CoCP**) (Doc

Ref. 8.11(D) [APP-615]) recommends site speed restrictions of <10 knots. Vessels travelling at high speeds are considered to be more likely to collide with marine mammals, and those travelling at speeds below 10 knots would rarely cause any serious injury (Ref. 9.2).

9.3.66 As such, there will be **no adverse effect on the integrity of The Wash and North Norfolk Coast SAC** from any potential for increased vessel collision risk to foraging harbour seal, including as a result of the dredging and installation of the offshore infrastructure for the desalination plant.

9.4 Updated assessment – Inter-pathway effects

9.4.1 The potential effects identified and assessed for Proposed Change 19 have the potential to interact with each other or other potential effects during the construction period, which could give rise to interactive effects for the Sizewell C Project as a whole. These effects are reviewed below.

i. Water quality effects – marine environment

9.4.2 Potential changes to water quality as a result of the desalination plant would occur during the construction period. Other potential water quality effects during the construction period include increased suspended sediments during dredging for the FRR, CDO and BLF.

9.4.3 However, as outlined in **Fourth ES Addendum** (Doc Ref. 6.18), dredging for the desalination plant will not interact with other project activities such as dredging for the FRR or CDO.

9.4.4 Dredging activities for the desalination plant, which would have the same effect as those assessed for the dredging for the FRR, could coincide with maintenance dredging for the enhanced permanent BLF. Which could lead to increased suspended sediments. However, the impact of combined dredge plumes for the BLF maintenance and dredging for the FRR was empirically modelled in **Volume 2, Chapter 22, Appendix 22J** [APP-327] and it was concluded that the inter-relationship effect due to the temporal coincidence of the dredge activities would not result in changes in the original assessment. This conclusion remains the same should dredging for the desalination headworks coincide with maintenance dredging for the BLF.

9.4.5 Any potential changes to water quality would not exceed or add to the maximum area for changes in water quality (7.26km^2) previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178] as outlined in **Sections 9.1a)i**, **9.2a)i** and **9.3a)i**.

9.4.6 Therefore, there would be no additional effects during the construction of Sizewell C for marine mammals, as all potential water quality effects are within the maximum area assessed. There is no change to the conclusions in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.4.7 There would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

ii. Disturbance effects on species populations

9.4.8 Any disturbance from underwater noise during dredging or removal of the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above. Therefore, there would be no additional disturbance effects from the dredging and removal during the construction phase compared to the worst-cases previously assessed and the outcomes of the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.4.9 There is no change to the conclusions in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-173].

9.4.10 Therefore, there would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

iii. Direct habitat loss and direct / indirect habitat fragmentation

9.4.11 Any changes to habitats as a result of dredging (0.0026km^2) for the desalination plant are within the maximum potential area for water quality effects during the dredging and the maximum potential areas of effects from underwater noise on marine mammals and their prey during the dredging. Therefore, there would be no additional displacement effects for marine mammals as a result of any changes to habitats during dredging for the desalination plant.

9.4.12 As outlined in **Fourth ES Addendum** (Doc Ref. 6.18), the individual dredge events would be short in duration and at individual scales with limited, localised impacts, and would not interact.

9.4.13 As outlined in **Sections 9.1a)iii**, **9.2a)iii** and **9.3a)iii**, the addition of the dredge area for the desalination plant would result in an updated total of 0.0286km^2. However, this does not change the outcome of the

assessments and conclusions in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.4.14 There would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

iv. Physical interaction between species and project infrastructure

9.4.15 As outlined in **Sections 9.1a)iv**, **9.2a)iv** and **9.3a)iv**, the assessments in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) for potential for increased vessel collision risk were based on an area of 6.5km^2 (the marine area within the Order Limits). Therefore, there is no additional vessel collision risk compared to what was previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178] from any additional vessels associated with the desalination plant and vessels involved in other construction activities, such as the dredging for the FRR.

9.4.16 There is no change to the conclusions in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.4.17 There would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

9.5 Updated assessment – In-combination effects

9.5.1 There would be no change to the in-combination effects as assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-178]), as the proposed changes are within the worst-case previously assessed.

i. Water quality effects – marine environment

9.5.2 Any potential changes to water quality would not exceed or add to the maximum area for changes in water quality (7.26km^2) previously assessed in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-173], as outlined in the updated assessments in **Sections 9.1a)i**, **9.2a)i** and **9.3a)9.3a)i**.

9.5.3 Therefore, there would be no additional effects during the construction of the Sizewell C Project for marine mammals as all potential water quality effects are within the maximum area assessed. As a result there would be

no change to the previously assessed worst-case in the in-combination assessments in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-178].

9.5.4 There is no change to the conclusions in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.5.5 There would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

ii. Disturbance effects on species populations

9.5.6 Any disturbance from underwater noise during dredging or removal of the desalination plant, is within the maximum potential area of disturbance during construction previously assessed, as outlined above.

9.5.7 Therefore, there would be no additional disturbance effects from the dredging and removal of the desalination plant during the construction phase compared to the worst-case previously assessed for in-combination effects in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and first **Shadow HRA Addendum** [AS-178].

9.5.8 The MMMP would reduce the risk of any permanent auditory injury to marine mammals during piling. The Southern North Sea SAC SIP would reduce the potential for the significant disturbance as a result of underwater noise during construction period of Sizewell C in-combination with other projects and noise sources.

9.5.9 As a result, there would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

iii. Direct habitat loss and direct / indirect habitat fragmentation

9.5.10 As outlined in **Sections 9.1a)iii**, **9.2a)iii** and **9.3a)iii**, the addition of the dredge area for the desalination plant would result in an updated total of 0.0286km^2. However, this does not change the outcome of the in-combination assessments and conclusions in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.5.11 There would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast

SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

iv. Physical interaction between species and project infrastructure

9.5.12 As outlined in **Sections 9.1a)iv**, **9.2a)iv** and **9.3a)iv**, the assessments in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) for potential for increased vessel collision risk were based on an area of 6.5km^2 (the marine area within the Order Limits). Therefore, there is no additional vessel collision risk compared to what was assessed for in-combination effects in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.5.13 There is no change to the conclusions in the **Shadow HRA Report** (Doc Ref. 5.10 [APP-145]) and the first **Shadow HRA Addendum** [AS-178].

9.5.14 There would be **no adverse effects on integrity** of the Humber Estuary SAC, Southern North Sea SAC and The Wash and North Norfolk Coast SAC in relation to the conservation objectives for grey seal, harbour porpoise and harbour seal, respectively.

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