Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Appendix 21 to Deadline 2 Submission: Report to Inform Appropriate Assessment - Part 2 of 2

Relevant Examination Deadline: 2

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10 Assessment criteria

10.1.1 The assessment approach being applied here is to first summarise each designated site screened in for LSE in turn, highlighting the feature(s) screened in together with the site's conservation objectives and the effects identified as resulting in LSE. To minimise the potential for repetition, the determination of AEoI that follows is made on a receptor by receptor basis – however the relevant sites (and their features) are identified for each receptor, together with the relevant effects.

10.1.2 The nature of each relevant effect is then described (e.g. in terms of scale, duration, frequency, etc), drawing on the relevant project literature to minimise repetition, and summarising the relevant conclusion from the ES. A conclusion on AEoI is then drawn for each site feature screened in for LSE, with these conclusions summarised on a site by site basis in Table 7.3.

10.2 Subtidal and benthic intertidal habitats

10.2.1 The RIAA has been prepared in accordance with Advice Note 10: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (PINS, 2016), with the method for determining potential impact with respect to subtidal and intertidal benthic ecology being compliant with the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines (CIEEM, 2016).

10.2.2 The assessment criteria and conclusions presented within section 10 of the ES Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology have been drawn on to inform this report when considering the potential for adverse effects on site integrity with respect to intertidal and benthic ecology features, with the ES conclusions on significance being considered here specifically in the context of the conservation objectives of the designated sites being assessed. The final assessment for each effect is based upon expert judgement. Where possible, parameters are quantified and predicted changes presented.

10.2.3 Full detail of the assessment criteria and assignment of significance applied within the ES are provided within that chapter, and take account of the following:

- Sensitivity/ importance of the environment (drawing on MarLIN and MARESA sensitivity categories[73, 74]);
- Magnitude of impact (the degree of change from baseline, in terms of: spatial extent, duration, timing, seasonality and/ or frequency);
- Significance of potential effect in terms of major/ moderate/ minor and negative/ beneficial (defined in a matrix combining sensitivity and magnitude).

10.2.4 Where the assessment being made relates to intertidal habitats as habitats used by features of the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar, the habitat assessment follows the approach relevant to subtidal and benthic intertidal habitats. The subsequent consideration of the potential for an indirect effect on the designated species of the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar takes account of the assessment criteria and assignment of significance applied in Volume 3, Chapter 5: Onshore Biodiversity Chapter (Application Ref 6.3.5) of the ES, as noted below.

[73] https://www.marlin.ac.uk/species/MarLIN-sensitivity-methods

[74] http://www.marlin.ac.uk/species/sensitivity_rationale

10.3 Marine Mammals

10.3.1 As noted in section 5, certain assumptions have been made regarding disturbance in harbour porpoise that may arise as a result of various activities that generate noise. In line to the approach to screening, as discussed in section 7.5, these have been applied in assessments of all sites where harbour porpoise are a consideration, regardless of the member state within which the site is located. As regards piling, these assumptions have drawn on a body of literature, which in turn are drawn on within JNCC 2016, namely Dahne *et al.* (2013) and Tougaard *et al*. (2014), the latter being a report produced by an expert group convened under the Habitats and Wild Birds Directives – Marine Evidence Group. The Tougaard *et al*. (2014) report drew on a number of empirical sources, including Dahne *et al*. (2013), but also Brandt *et al*. (2011), Brandt *et al*. (2012) (contained within Popper & Hawkins (2012)), Braasch *et al*. (2013), Thompson *et al*. (2010) and Bailey *et al*. (2010). These studies reported direct observations during wind farm construction at projects across Europe, thus enabling an Effective Deterrent Radius (EDR) to be established. The EDR is defined by Tougaard *et al*. as reflecting the overall loss of habitat that would occur if all animals vacated an area with a radius of the EDR around the pile driver, being equivalent to the mean loss of habitat per animal. More noise-tolerant animals will lose less than this mean area, while less noise-tolerant animals would lose more.

10.3.2 For seismic survey, the relevant EDR is less clear. The draft conservation advice published in January 2016 identified a range of 5 km for seismic surveys. The range was later called into question following the submission of the shadow HRA for Hornsea Project One in 2016. The use of a 10 km range for seismic survey, as considered in the OESEA 3 was noted (although it is pertinent to note that the 10 km range applied in the OESEA 3 was in relation to the firing of small air guns and is therefore not considered typical of all types of seismic survey and particularly the types typically used for offshore wind farm site investigation work). The 2013 Thompson *et al*. paper (which investigated short-term disturbance of harbour porpoise from an air gun survey) found avoidance movements in harbour porpoise within a 5-10 km range of the seismic vessel. It is, therefore, clear that a blanket application of 10 km EDR for all geophysical and seismic survey is unlikely to be appropriate, and that project specific circumstances should be taken into account.

10.3.3 No formal EDR information has been provided for explosion of UXO, although Natural England did reference the 26 km value for UXO clearance in their East Anglia THREE letter of 28th September 2016 and confirmed at the Thanet Extension Steering Group meeting on 2nd October 2017 that the advice has not changed.

10.3.4 A suitably precautionary radius of disturbance from the above specific sources of noise has therefore been established in terms of an EDR, with agreement from Natural England at the Evidence Plan meeting on 2nd October 2017 that these EDRs represent a reasonable approach. The EDRs applied are as follows:

- An EDR of 26 km from the location of piling;
- A range of EDRs for seismic survey, being 5 or 10 km from the location of seismic activity; and
- An EDR of 26 km from UXO clearance.

10.3.5 For seals, the approach followed applies that used within the ES (Volume 2: Chapter 7: Marine Mammals (Application Ref 6.2.7) to determine the numbers of seals that may be affected as part of the overall population within the study area.

10.3.6 The determination of AEoI with regards marine mammals draws on the existing project literature, to provide the required information on the baseline environment (both locally and across the North Sea management unit).

10.4 Offshore Ornithology

10.4.1 The assessment has been based on the relevant guidance for conducting HRA and assessing OWFs (e.g. European Commission, 2011; Maclean *et al*., 2009; Natural England, 2010; PINS Advice Note Ten) and applied the criteria contained in that guidance where relevant to the interest features under consideration.

10.4.2 The screening criteria applied are precautionary and are:

- the occurrence of the species in more than very small numbers or more than very infrequently during the 26 consecutive months of baseline characterisation surveys within the Thanet Extension survey area (this covered TOWF, Thanet Extension proposed array and the area covered by a distance of 4 km projected around the proposed array);
- the species has been identified as sensitive to displacement and disturbance in relevant guidance (Bradbury *et al*., 2014; Furness and Wade 2012; Furness *et al*., 2013); and
- the species has been identified as sensitive to collision risk in relevant guidance (Bradbury *et al*., 2014; Furness and Wade 2012; Furness *et al*., 2013).

10.4.3 The determination of AEoI is based on the factors that contribute to the definition of maintaining integrity, namely that the ecological structure and function of the site is not adversely affected, that the ability of the habitat to sustain the bird species that are interest features is not adversely affected (i.e. that breeding, roosting and foraging locations are maintained and that food sources are maintained) and that the population of the interest feature is maintained both in numbers and across the area of the site. Where relevant, the long-term viability of the population has been assessed using population modelling.

10.5 Onshore Biodiversity

10.5.1 The RIAA has been prepared in accordance with Advice Note 10: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (Planning Inspectorate, 2016), with the method for determining potential effects with respect to onshore biodiversity based on the CIEEM guidelines (CIEEM, 2016).

10.5.2 The assessment criteria and conclusions presented within sections 5.10-5.12 of the ES Volume 3, Chapter 5, Onshore Biodiversity (Application Ref 6.3.5) have been drawn on to inform this report when considering the potential for adverse effects on site integrity with respect to onshore biodiversity features. The ES conclusions on significance are considered here specifically in the context of the conservation objectives of the designated sites being assessed. Full detail of the assessment criteria and assignment of significance applied within the ES are provided within Volume 3, Chapter 5, Onshore Biodiversity (Application Ref 6.3.5).

11 Assessment of Adverse Effect Alone

11.1.1 Where a LSE on a European site has been identified, there is a requirement to consider whether those effects will adversely affect the integrity of the site in view of its conservation objectives. The conclusion on LSE for Thanet Extension alone is presented in Table 7.3, with the conservation objectives for all relevant sites provided in section 9 and receptors screened in provided in section 7. The information is presented below according to the following receptor groupings:

- Subtidal and Benthic Intertidal Habitats;
- Marine Mammals;
- Offshore Ornithology; and
- Onshore Biodiversity.

11.2 Subtidal and Benthic Intertidal Habitats

11.2.1 A description of the significance of project level effects upon the receptors grouped under 'subtidal and benthic intertidal habitats', as relevant to the designated sites and their associated features screened in for LSE, is provided below. All designated sites screened in, including the features and effects for which potential for LSE has been concluded, are summarised in Table 7.3.

Construction and Decommissioning

Accidental Pollution (construction and decommissioning)

11.2.2 The potential for an AEoI as a result of accidental pollution on subtidal benthic and intertidal habitats during construction and decommissioning relates to the following designated sites and relevant features (i.e. those features screened in for LSE):

- Thanet Coast SAC;
  - Chalk reefs; and
  - Submerged or partially submerged sea caves.
- Margate and Longsands SAC;
  - Sand banks which are slightly covered by sea water all the time.
- Thanet Coast & Sandwich Bay SPA; and
  - Intertidal habitats (including saltmarsh) used by ruddy turnstone (Non-breeding); and
  - Intertidal habitats (including saltmarsh) used by European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar.
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates; and
  - Ramsar Criterion 6 – intertidal habitats (including saltmarsh) used by species/ populations occurring at levels of international importance: Ruddy turnstone (Non- breeding).

11.2.3 The potential for accidental pollution to affect subtidal benthic and intertidal habitats (and the species these habitats support) was not considered in the ES (Volume 2, Chapter 5: Subtidal Benthic and Intertidal Ecology (PINS Ref APP-046/ Application Ref 6.2.5)), given the inclusion of the following in the project specific mitigation table (Table 5.11 of APP-046):

A Project Environment Management Plan (PEMP) will be produced and followed to cover the construction and O&M phases of Thanet Extension. The PEMP will incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. MMO, MCA and the project site coordinator). A Decommissioning Programme will be developed to cover the decommissioning phase.

Typical measures will include: only using chemicals approved by Cefas under the Offshore Chemicals Regulations 2002; storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials. The purpose of these measures ensure that potential for contaminant release is strictly controlled and therefore provides protection to marine life across all phases of the life of the wind farm.

11.2.4 The implementation of the PEMP, produced in conjunction with Natural England and provided for in the DCO as part of the standard dML requirements, enables the conclusion that there is, therefore, no AEoI to the subtidal benthic and intertidal ecology in relation to accidental pollution from Thanet Extension alone and therefore, subject to natural change, the features of the designated sites will be maintained in the long term with respect to the potential for accidental pollution.

11.2.5 Additional control is provided within the Code of Construction Practice (CoCP), together with the requirement for a Contaminated Land and Groundwater Plan.

Temporary Habitat Loss and Disturbance

11.2.6 The potential for an AEoI as a result of temporary habitat loss on subtidal and benthic intertidal habitats during construction and decommissioning relates to the following designated sites and the relevant features (i.e. those features screened in for LSE):

- Thanet Coast SAC;
  - Chalk reefs.

- Thanet Coast & Sandwich Bay SPA; and
  - Intertidal habitats (including saltmarsh) used by ruddy turnstone (Non-breeding); and
  - Intertidal habitats (including saltmarsh) used by European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar.
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates; and
  - Ramsar Criterion 6 – intertidal habitats (including saltmarsh) used by species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

11.2.7 For both the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar sites, the potential for AEoI relevant to intertidal habitats (including saltmarsh) arises from the potential effect on intertidal habitats used by qualifying species. It should be noted that throughout this section, where reference is made to 'intertidal habitats' this now includes saltmarsh habitat as well which has been screened in to the assessment.

11.2.8 Offshore, there is potential for temporary habitat loss and disturbance due to the installation of structures (i.e. possible cable protection and permanent moorings), cable laying operations (including anchor placements) and seabed preparation. Within the intertidal, temporary loss/ disturbance of habitat will occur from cable laying operations and the works at the landfall. Table 5.2 outlines the design envelope and the maximum adverse scenario for intertidal and subtidal benthic ecology, with the total change for subtidal and intertidal benthic habitats highlighted below.

11.2.9 None of the designated sites screened in for LSE for habitat loss/ disturbance overlap with the WTG array, but Thanet Coast SAC overlaps with the OECC and both the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar interact with the cable corridor where it passes through the intertidal area. The assessment of potential for AEoI in relation to direct temporary habitat loss/ disturbance during construction and decommissioning is therefore limited to these sites and relevant project scenarios.

11.2.10 The total maximum area of temporary subtidal habitat loss due to construction activities described in Table 5.2 is predicted to be approximately 1,594,629 m^2 (1.59 km^2). This equates to 0.13% of the total seabed area within the wider Thanet Extension benthic ecology study area (1,230.5 km^2), the large proportion of which falls outside of a designated site.

11.2.11 Within the subtidal, of the total temporary habitat disturbance described in Table 5.2, a maximum of 1,490,400 m^2 (1.49 km^2) will be temporarily disturbed within the subtidal areas of the Thanet Extension OECC as a result of cable burial and associated anchor placements. This equates to 0.12% of the total seabed area within the wider Thanet Extension benthic study area. Again, the vast proportion of that falls outside any designated site.

11.2.12 Within the intertidal, both saltmarsh and the muddy foreshore will be temporarily disturbed during construction, comprised of some 80,000 m^2 of intertidal foreshore (during trenching) and 3,872 m^2 of saltmarsh (combination of trenching and the cofferdam).

11.2.13 During decommissioning, direct disturbance due to operations to remove foundations, inter-array cables, export cables (including use of jack-up vessels) equates to the total subtidal temporary habitat loss of 556,071.60 m^2 (noting that only a proportion of this relates to the OECC and only a proportion of that would fall within a designated site); and total intertidal temporary habitat loss of 80,000 m^2.

11.2.14 A description of the significance of temporary habitat loss or disturbance upon all benthic subtidal and intertidal receptors during construction and decommissioning phases is provided in Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5). The relevance to the designated sites screened in for LSE is determined below.

Thanet Coast SAC

11.2.15 For the Thanet Coast SAC, the designated feature screened in for LSE in relation to habitat loss and disturbance is chalk reefs. Following refinements to the OECC RLB, the OECC (not including the cable exclusion area, since cables would not be installed in that area in any case) no longer overlaps with the SAC, thus preventing any direct disturbance from cable installation on any of the features of the SAC. Furthermore, it should be noted that part of the cable exclusion zone overlaps with the dredged channel for the approach to Ramsgate Harbour.

11.2.16 The site specific surveys undertaken (Fugro, 2017a, b; Volume 4, Annex 5-2, Application Ref 6.4.5.2), including the drop down video, were designed to identify any features of nature conservation importance. No chalk reef features were identified within the site specific surveys within either the array or OECC.

11.2.17 Of note, the site specific surveys also considered the potential for *Sabellaria spinulosa* reef, although not a designated feature of the SAC. No *S. spinulosa* reef was identified within the proposed development area for Thanet Extension in the baseline surveys (Volume 4, Annex 5-2 (Application Ref 6.4.5.2)). However, as part of the embedded mitigation for the project, pre-construction surveys will be undertaken in advance of construction and the presence or absence of *S. spinulosa* reefs will be confirmed and any core reef will then be subject to the Biogenic Reef Mitigation Plan. The mitigation plan will ensure that any impacts to core reef are avoided. Should chalk reefs be identified during these surveys, then these would similarly be included within the Biogenic Reef Mitigation Plan.

11.2.18 There will therefore be no direct temporary loss or disturbance of the designated feature 'chalk reef' for the Thanet Coast SAC during construction or decommissioning and, therefore, there is no AEoI to the chalk reef feature of the Thanet Coast SAC in relation to temporary loss or disturbance from Thanet Extension alone and therefore, subject to natural change, the chalk reef feature will be maintained in the long-term.

Thanet Coast and Sandwich Bay SPA

11.2.19 Temporary habitat loss/ disturbance will occur during construction and decommissioning within the intertidal habitats, which include the saltmarsh and the mudflat foreshore. These habitats represent potential roosting and feeding habitats for the designated bird species European golden plover and ruddy turnstone within the Thanet Coast and Sandwich Bay SPA. Temporary disturbance will occur in both the intertidal foreshore and the saltmarsh habitat, with 80,000 m^2 of the intertidal foreshore disturbed (0.71% of the total intertidal foreshore habitat within the SPA) and 3,872 m^2 of saltmarsh habitat disturbed (approximately 0.35% of the total saltmarsh habitat within the SPA). The works will be undertaken wholly between April to September inclusive, to avoid the October to March period which is directly sensitive to the ruddy turnstone and European golden plover features of the Thanet Coast and Sandwich Bay SPA, with the potential for disturbance in relation to the habitats therefore following construction as these habitats recover.

11.2.20 Saltmarsh is common throughout Pegwell Bay and is present throughout the study area, including further south towards Sandwich Bay. Given that the intertidal habitats are common and widespread throughout the region, the area directly affected represents a very small footprint compared to their overall extent. It is also of note that recent monitoring surveys indicate that following the TOWF installation the saltmarsh feature reverted to its pre-construction status with no significant change being found after two years. Through discussion within the evidence plan (12th July 2017) it has also been confirmed that the saltmarsh is, in areas around the proposed landfall, well established and as such less diverse than the patchier *Salicornia* saltmarsh to the north, in proximity to the hoverport.

11.2.21 The intertidal zone within Pegwell Bay consists of mobile sediments with some restricted sediment scour. The communities that characterise these biotopes are predominantly infaunal mobile species including polychaetes and bivalves, which are capable of re-entering the substratum following disturbance. The species and habitats identified during the intertidal characterisation surveys (LS.LSa.FiSa[75], LS.LSa.MuSa.CerPo[76] and LS.LSa.MuSa[77]) are typical of the wider region of the surrounding area. All three biotopes have been assessed according to the MarLIN or MarESA criteria as having a high or medium recoverability (resilience) to direct disturbance, with the habitats directly affected considered to generally have low sensitivity to disturbance of this nature.

11.2.22 While it is likely that some of the characterising species (*Macoma balthica* and *Arenicola marina*) would be damaged by the physical impacts of the trench excavation in the intertidal, both species are able to recolonise disturbed habitat rapidly. Particularly in the case of *M. balthica,* following sediment removal (dredging) within the area, recovery of the population within the disturbed area had recovered to the same as the unaffected areas. Within one year, two generations could be identified, showing that recovery was both from adults migrating into the area and larval recruitment (Bonsdorff, 1984).

[75] https://www.marlin.ac.uk/habitats/detail/1125 - biotope Polychaetes in littoral fine sand (LS.LSa.FiSa.Po) has been used to provide the MarESA assessment for this biotope. LS.LSa.FiSa.Po is a sub-biotope of LS.LSa.FiSa, however the characterising species of the two biotopes are identical and the sensitivity assessment is therefore considered appropriate for use alongside expert judgement of the impacts on this biotope.

[76] http://www.marlin.ac.uk/habitats/detail/206

[77] https://www.marlin.ac.uk/habitats/detail/21 - a MarESA assessment has not been carried out for this species, so the evidence from the MarLIN assessment has been used.

11.2.23 To mitigate against any temporary loss or disturbance, as part of the mitigation measures embedded into the Thanet Extension development, and as part of the application, a Saltmarsh Mitigation, Reinstatement and Monitoring Plan (SMRMP) has been produced (Application Ref 8.13), which will be developed and agreed with the relevant stakeholders. A Phase 1 walkover survey will be undertaken of the intertidal area to confirm the pre-construction delineation of sensitive habitats present. The plan provides for the handling of trenched material to facilitate reinstatement. The resulting impacts to the saltmarsh will be localised and short-term, with the SMRMP ensuring that the saltmarsh is properly reinstated to its pre-construction condition.

11.2.24 The conservation objectives for the SPA require maintenance of the extent and distribution of the habitats of the qualifying features, and the structure and function of the habitats of the qualifying features. The impacts resulting from temporary habitat loss/ disturbance will be temporary and of short-term duration, extending across a very small proportion of the available habitat and with only a single event in each location; therefore, the magnitude of the impact is assessed as low for the saltmarsh and mudflat foreshore and the sites conservation objectives will be maintained in the long-term.

11.2.25 There is, therefore, no potential for AEoI to the intertidal habitats used by the designated features of the Thanet Coast and Sandwich Bay SPA in relation to temporary habitat loss/ disturbance during construction and decommissioning from Thanet Extension alone and therefore, subject to natural change, the intertidal habitats (including the saltmarsh) of the designated ruddy turnstone and European golden plover features will be maintained in the long-term with respect to the potential for effect from temporary habitat loss and disturbance.

Thanet Coast and Sandwich Bay Ramsar

11.2.26 Temporary habitat loss/ disturbance will occur during construction and decommissioning within the intertidal habitats, which include saltmarsh and the mudflat foreshore. These habitats represent potential roosting and feeding habitats for the ruddy turnstone designated bird species within the Thanet Coast and Sandwich Bay Ramsar. The potential for an effect on ruddy turnstone is assessed above as part of the consideration of the Thanet Coast and Sandwich Bay SPA; that assessment applies equally to the ruddy turnstone feature of the Thanet Coast and Sandwich Bay Ramsar and is therefore not repeated here.

11.2.27 There are no conservation objectives for the Thanet Coast and Sandwich Bay Ramsar, however the conservation objectives for the SPA require maintenance of the extent and distribution of the habitats of the qualifying features, and the structure and function of the habitats of the qualifying features. The impacts resulting from temporary habitat loss/ disturbance will be temporary and of short-term duration, extending across a very small proportion of the available habitat and with only a single event in each location; therefore, the magnitude of the impact is assessed as low for the saltmarsh and mudflat foreshore and the site will be maintained in the long-term. Further, the embedded mitigation as regards the timing of works will occur during the period April to September inclusive, to avoid the winter period considered directly important to the designated ruddy turnstone feature of the Thanet Coast and Sandwich Bay Ramsar, with the potential for disturbance in relation to the intertidal habitat therefore following construction as these habitats recover.

11.2.28 There is, therefore, no potential for AEoI to the intertidal habitats used by the ruddy turnstone designated feature of the Thanet Coast and Sandwich Bay Ramsar in relation to temporary habitat loss/ disturbance during construction and decommissioning from Thanet Extension alone and therefore, subject to natural change, the intertidal habitats and the designated ruddy turnstone feature will be maintained in the long-term with respect to the potential for effect from temporary habitat loss and disturbance.

11.2.29 The Relevant Representation from Natural England (Project Ref. RR-053) requested further consideration of the bug *Orthotylus rubidus*, which forms part of the wetland invertebrate assemblage qualifying feature. This species has very specific habitat requirements and is associated with glassworts. It is not found on open saltmarshes, but occurs in areas which, though saline, are not regularly inundated by the sea (see ES Volume 4, Annex 5-6 Terrestrial Invertebrate Assessment Report (Document Ref: 6.5.5.6). Examples of habitats in which the species has been found in recent years include brackish muddy silt and seepage pools in Norfolk (Widgery, 2007) and saline shore pools in Suffolk (Cuming & Bowdrey, 2010). In 2011 the species was recorded on the Isle of Sheppey in Kent (Jim Flanagan, pers. comm.) behind an embankment, subject to very infrequent inundation, where glassworts were well established.

11.2.30 Although the possible presence of this species cannot be conclusively ruled out, given its very specific habitat requirements *Orthotylus rubidus* is not likely to be present within the area that would be affected by cable laying operations and the works at the landfall, which is characterised by open saltmarsh and mudflats. Furthermore, *Orthotylus rubidus* was not recorded during an invertebrate survey of saltmarsh habitat in Pegwell Bay in 2009 (Godfrey, 2010) (although it was not specifically searched for).

11.2.31 Mitigation of relevance to *Orthotylus rubidus*, if present, includes the implementation of the SMRMP (Document Ref: 8.13). In addition, a detailed invertebrate survey of affected areas will be undertaken prior to construction commencing and, in the unlikely event that it is present, specific measures relating to *Orthotylus rubidus* will be included within a TIMS (see Table 6.1). The precise selection of measures to be employed would depend on the results of the survey and the final design solution adopted, although at this stage it is considered likely that the measures relevant to *Orthotylus rubidus*, if present, would include: the avoidance of suitable habitat by micro-siting, where possible; the protection of suitable habitat against inadvertent damage, e.g. by use of temporary fencing and ECoW supervision; and, if necessary, the reinstatement of suitable habitat as soon as possible following construction. Suitable habitat for *Orthotylus rubidus* is transient in nature and the species is therefore adapted to the temporary loss of habitat and will readily recolonise new areas of suitable habitat. Reinstated habitats are therefore likely to be re-occupied by the species relatively quickly. The TIMS will form part of the detailed LEMP, which will be subject to agreement with the relevant planning authorities, in consultation with Natural England and other relevant stakeholders, prior to construction commencing. Further details are provided in the Outline LEMP (Document Ref. 8.7).

11.2.32 Although there are no published conservation objectives for the Ramsar site it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Given the very low chance that *Orthotylus rubidus* is present within the affected area and following the implementation of the embedded mitigation, the assumed conservation objectives are not likely to be compromised. In respect of temporary loss or disturbance to intertidal habitats during construction there is therefore no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site from Thanet Extension alone.

Increased suspended sediment and associated deposition

11.2.33 The potential for an AEoI as a result of an increase in SSC and subsequent deposition on subtidal and benthic intertidal habitats during construction and decommissioning relates to the following designated sites and the relevant features (i.e. those features screened in for LSE):

- Thanet coast SAC; ·
  - Chalk reefs.
- Margate and Long Sands SAC;
  - Sand banks which are slightly covered by sea water all the time.
- Thanet Coast & Sandwich Bay SPA.
  - Intertidal habitats used by ruddy turnstone (Non-breeding); and
  - Intertidal habitats used by European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar.
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates; and
  - Ramsar Criterion 6 – Intertidal habitats used by species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

11.2.34 For both the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar sites, the potential for AEoI relevant to intertidal habitats arises from the potential effect on the qualifying bird species.

11.2.35 There is the potential for a temporary increase in SSCs and subsequent deposition to result from construction operations; such as cable laying operations, foundation installations and seabed preparation. The temporary, intermittent and localised increase in SSCs can affect the benthos e.g. through lower light levels, with deposition potentially leading to smothering.

11.2.36 Temporary increases in SSC and associated sediment deposition are expected from the foundation and cable installation works and seabed preparation works. Volume 2, Annex 2-1: Marine Geology, Oceanography and Physical Processes Technical Report (Application Ref 6.4.2.1) provides a full description of the physical assessment, with a summary of the existing baseline and the maximum design scenarios associated with the impact summarised below.

11.2.37 SSC in the southern North Sea varies widely both spatially and temporally, with a general pattern of an inshore to offshore gradient in SSC. The highest SSCs are observed close to the mouths of large estuaries, such as the Thames. Within the array area of Thanet Extension, surface SSCs average more than 10 mg/l over the year, with levels in the winter generally being between 30 – 80 mg/l although up to 100 mg/l has been recorded. Within the OECC, surface SSCs are between 10 – 20 mg/l during summer and above 40 mg/l during winter. Significantly higher levels may be seen during storm events.

11.2.38 SSCs may reach thousands of mg/l during seabed preparation within the array, however this will be only short-term during the settling stage of the plume. The passive stage of the plume may result in SSCs up to hundreds of mg/l for up to two hours, with the contribution of the works to SSCs reducing to less than 5mg/l within 24 hours, which is within natural variation. Cable installation works may result in SSCs of up to 10mg/l above background levels up to 10 km from the cable route, however, this is within natural variation for the area. Sediment deposition will be concentrated within a few 100 m of the works, with fine grained material dispersed more widely and will not settle with measurable thickness. Deposition arising from the cable installation may result in sediment deposition of an average of 0.05 m within approximately 75 m of the cable route, with fine grained material dispersed more widely that will not settle with measurable thickness.

11.2.39 SSCs of between 5 – 10 mg/l are expected to extend to a distance of 10 km from the dredging/ mass flow excavator site. The impacts of sediment deposition are not known at this stage as the volume of material that would need to be removed is unknown. However, the extent of any deposition would be restricted to the local area (tens to hundreds of metres) and local accumulations would be subject to redistribution under prevailing hydrodynamic conditions.

11.2.40 The scenario that results in the greatest impact on intertidal habitats from cable installation is ploughing and the associated formation of berms. While these berms are present on the beach, they will be subject to tidal dispersion, although some of this will result in natural backfill of the trench. It is expected that the berms would be present for only a very short period of time and so the degree of redistribution that may occur is highly limited. SSCs will be increased locally but rapidly attenuate to natural levels.

11.2.41 After the trench has been backfilled, it is expected that re-working by waves and currents will quickly (in the order of days to weeks) redistribute and smooth any remaining local disturbances. As such all impacts will be short-term and highly localised.

Thanet Coast SAC

11.2.42 The magnitude of the impact as regards subtidal ecology has been assessed within the ES (Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5)) as low, with the maximum sensitivity of the receptors being medium. Therefore, the significance of effect from changes in SSC and associated sediment deposition in the subtidal areas was concluded to be minor, which is not significant in EIA terms. Furthermore, the post-construction surveys undertaken for TOWF identified that changes in faunal composition between pre- and post-construction were only as a result of natural variation, suggesting no long-term impacts from increased SSC or increased sediment deposition (MESL, 2013). As such, the assessment of the significance of effects as not significant remains valid.

11.2.43 Although impacts are predicted to be low, there is potential for the sediment released to reach the Annex I habitat (chalk reef) qualifying feature of the Thanet Coast SAC. The Regulation 33 document for the North East Kent Coast EMS[78] (which includes the Thanet Coast SAC) finds the following in relation to the chalk reefs and siltation:

'The communities found on the reefs around Thanet are however, naturally tolerant of a degree of siltation due to the relatively high sediment load in the water column. Because of this, the reefs of the Thanet coastline are considered to be of a low sensitivity to physical damage through siltation.'

11.2.44 It is therefore considered that, given the short-term and temporary nature of the change, the existing levels of SSC in the area, the ES conclusion of minor significance and the known low sensitivity of the chalk reef feature to siltation, it is concluded that the sites conservation objectives will be maintained in the long-term. There is, therefore, no AEoI to the chalk reef feature of the Thanet Coast SAC in relation to temporary and short-term increased SSC and associated deposition from Thanet Extension alone during construction and decommissioning and therefore, subject to natural change, the chalk reef feature will be maintained in the long-term.

Margate and Long Sands SAC

11.2.45 The magnitude of the impact as regards subtidal ecology has been assessed within the ES (Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5)) as low, with the maximum sensitivity of the receptors being medium. Therefore, the significance of effect from changes in SSC and associated sediment deposition in the subtidal areas was concluded to be minor, which is not significant in EIA terms. Furthermore, the post-construction surveys undertaken for TOWF identified that changes in faunal composition between pre- and post-construction were only as a result of natural variation, suggesting no long-term impacts from increased SSC or increased sediment deposition (MESL, 2013). As such, the assessment of the significance of effects as not significant remains valid.

11.2.46 Although impacts are predicted to be low, there is potential for the sediment released to reach the Annex I habitat (sand banks which are slightly covered by sea water all the time) qualifying feature of the Margate and Long Sands SAC. The array boundary for Thanet Extension is approximately 3 km from the boundary of the SAC, and therefore beyond the 560 m range for 0.05 m deposition highlighted in the ES (Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5)). Any short-term and temporary increase in SSC levels that reaches the SAC boundary will be reduced from the nearfield maximum, together with a reduced potential for deposition.

[78] http://publications.naturalengland.org.uk/file/3229392

11.2.47 The Regulation 35 Advice on Activities for the SAC[79] considers the vulnerability of the site to non-toxic contamination, specifically an increase in turbidity, concluding a low vulnerability (vulnerability being a function of sensitivity and exposure).

11.2.48 Given the short-term and temporary nature of the effect, combined with the existing SSC levels in the region, low vulnerability of the feature and lack of long-term impacts found following the construction of the TOWF, it is concluded that the sites conservation objectives will be maintained in the long-term. There is, therefore, no AEoI to the sand banks which are slightly covered by sea water all the time feature of the Margate and Long Sands SAC in relation to increased SSC and associated deposition from Thanet Extension alone during construction and decommissioning and therefore, subject to natural change, the sand banks which are slightly covered by sea water all the time feature will be maintained in the long-term.

Thanet Coast and Sandwich Bay SPA

11.2.49 Within the ES, the magnitude of the impact of an increase in SSC and subsequent deposition on the intertidal has been assessed as low, with the maximum sensitivity of the receptors being medium. Therefore, the significance of effect from changes in SSC and associated sediment deposition occurring as a result of cable installation activities in the intertidal area is concluded to be minor, which is not significant in EIA terms.

11.2.50 The species and habitats identified during the intertidal characterisation surveys (LS.LSa.FiSa, LS.LSa.MuSa.CerPo and LS.LSa.MuSa) are typical of the wider region of the surrounding area. All three biotopes have been assessed according to the MarLIN and MarESA criteria as having a high recoverability to changes in SSC, high recoverability to 'light' sediment deposition (5 cm) and a high to medium recoverability to 'heavy' sediment deposition (> 5 cm).

11.2.51 In addition, the intertidal zone of Pegwell Bay within the landfall area is an accretion zone, with sediment received from natural supplies including updrift, offshore and fluvial sources. While sands and silts are transported into Pegwell Bay on tidal currents, the majority of sediment transport occurs during storm surge events, with shingle movement, flattening of areas and berm creation in others. Therefore, the habitats identified within the landfall area will likely have a low intolerance to these impacts.

11.2.52 Given the habitats are naturally accreting and increases to SSCs will be local and rapidly attenuate to natural levels, the conservation objectives for the SPA, to ensure that the integrity of the site is maintained or restored, by maintaining or restoring the extent and distribution of the intertidal habitats of the qualifying species and overall structure and function of the habitats will not be compromised.

11.2.53 There is, therefore, no AEoI to the intertidal habitats used by the designated features of the Thanet Coast and Sandwich Bay SPA in relation to the short-term and temporary increased suspended sediments and deposition effects from Thanet Extension alone during construction and decommissioning and therefore, subject to natural change, the intertidal habitats for the designated ruddy turnstone and European golden plover features will be maintained in the long-term with respect to the potential for effect from an increase in SSC and subsequent deposition.

Thanet Coast and Sandwich Bay Ramsar

11.2.54 The potential for an effect on ruddy turnstone is assessed above as part of the consideration of the Thanet Coast and Sandwich Bay SPA; that assessment applies equally to the ruddy turnstone feature of the Thanet Coast and Sandwich Bay Ramsar and is therefore not repeated here.

11.2.55 Although the Ramsar site does not have conservation objectives, the conservation objectives of the SPA can be applied, to ensure that the integrity of the site is maintained or restored, by maintaining or restoring the extent and distribution of the habitats of the qualifying species and overall structure and function of the habitats will not be compromised.

11.2.56 There is, therefore, no AEoI to the intertidal habitats used by the designated ruddy turnstone feature of the Thanet Coast and Sandwich Bay Ramsar in relation to the short-term and temporary increased suspended sediments and deposition effects from Thanet Extension alone during construction and decommissioning and therefore, subject to natural change, the intertidal habitats for the designated ruddy turnstone feature will be maintained in the long-term with respect to the potential for effect from an increase in SSC and subsequent deposition.

[79] http://publications.naturalengland.org.uk/file/3271272

11.2.57 The wetland invertebrate assemblage species *Orthotylus rubidus* is not likely to be affected by increases in SSCs, even if present. This species has very specific habitat requirements and only occurs in areas which, though saline, are rarely inundated by the sea. As such, potentially suitable habitats, if present, are not likely to be regularly affected during the course of construction works. Furthermore, even in the event that suitable habitat for *Orthotylus rubidus* was inundated, impacts should not be significantly greater than those resulting from existing sedimentation events, e.g. following storm surges.

11.2.58 Although there are no published conservation objectives for the Ramsar site it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Given that suitable habitat for *Orthotylus rubidus* is very unlikely to be affected, and even if it was inundated the effect is unlikely to be greater than during existing sedimentation events, the assumed conservation objectives are will not be compromised. With respect to potential effects resulting from an increase in SSC and subsequent deposition during construction there is therefore no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site from Thanet Extension alone.

Operations and Maintenance

Accidental Pollution (operations and maintenance)

11.2.59 The potential for an AEoI as a result of accidental pollution on subtidal benthic and intertidal habitats during operations and maintenance relates to the following designated sites and relevant features (i.e. those features screened in for LSE):

- Thanet Coast SAC;
  - Chalk reefs; and
  - Submerged or partially submerged sea caves.
- Margate and Longsands SAC;
  - Sand banks which are slightly covered by sea water all the time.
- Thanet Coast & Sandwich Bay SPA; and
  - Intertidal habitats (including saltmarsh) used by ruddy turnstone (Non-breeding); and
  - Intertidal habitats (including saltmarsh) used by European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar.
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates; and
  - Ramsar Criterion 6 – intertidal habitats (including saltmarsh) used by species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

11.2.60 The potential for accidental pollution to affect subtidal benthic and intertidal habitats (and the species these habitats support) was not considered in the ES (Volume 2, Chapter 5: Subtidal Benthic and Intertidal Ecology (PINS Ref APP-046/ Application Ref 6.2.5)), given the inclusion of the following in the project specific mitigation table (Table 5.11 of APP-046):

A Project Environment Management Plan (PEMP) will be produced and followed to cover the construction and O&M phases of Thanet Extension. The PEMP will incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. MMO, MCA and the project site coordinator). A Decommissioning Programme will be developed to cover the decommissioning phase.

Typical measures will include: only using chemicals approved by Cefas under the Offshore Chemicals Regulations 2002; storage of all chemicals in secure designated areas with impermeable bunding (generally to 110% of the volume); and double skinning of pipes and tanks containing hazardous materials. The purpose of these measures ensure that potential for contaminant release is strictly controlled and therefore provides protection to marine life across all phases of the life of the wind farm.

11.2.61 The implementation of the PEMP, produced in conjunction with Natural England and provided for in the DCO as part of the standard dML requirements, enables the conclusion that there is, therefore, no AEoI to the subtidal benthic and intertidal ecology in relation to accidental pollution from Thanet Extension alone and therefore, subject to natural change, the features of the designated sites will be maintained in the long term with respect to the potential for accidental pollution.

Temporary habitat loss/disturbance

11.2.62 The potential for an AEoI as a result of temporary habitat loss/disturbance on subtidal and benthic intertidal habitats during O&M relates to the following designated sites and the relevant features (i.e. those features screened in for LSE):

- Thanet coast SAC;
  - Chalk reefs.
- Thanet Coast & Sandwich Bay SPA;
  - Intertidal habitats (including saltmarsh) used by ruddy turnstone (Non-breeding); and
  - Intertidal habitats (including saltmarsh) used by European golden plover (Non-breeding).

- Thanet Coast & Sandwich Bay Ramsar.
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates; and
  - Ramsar Criterion 6 – Intertidal habitats (including saltmarsh) used by species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

11.2.63 For both the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar sites, the potential for AEoI relevant to intertidal habitats (including saltmarsh) arises from the potential effect from temporary habitat loss/ disturbance on habitats used by qualifying bird species. Table 5.2 identifies that no substantive maintenance work is expected along the intertidal cables, with any temporay disturbance resulting from periodic preventative maintenance, likely to be yearly inspections together with any requirements following extreme events such as storms.

11.2.64 The potential for temporary habitat disturbance in the subtidal in relation to the designated sites and their relevant features screened in above is limited to works within the OECC, specifically within the section which passes through the Thanet Coast SAC. Any such works will be limited to vessel anchoring or similar, as no cables will be installed within the SAC boundary.

11.2.65 During O&M, temporary subtidal habitat disturbance will result from the use of jack-up vessels together with preventative maintenance of cables and potential need for cable repair or reburial.

11.2.66 A description of the significance of temporary habitat loss or disturbance upon all benthic subtidal and intertidal receptors during O&M phases is provided in Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5). The relevance to the designated sites screened in for LSE is determined below.

Thanet Coast SAC

11.2.67 For the Thanet Coast SAC, the designated feature screened in for LSE in relation to habitat loss and disturbance is chalk reefs. Following refinements to the OECC RLB, the OECC (not including the cable exclusion area, since cables would not be installed in that area in any case) no longer overlaps with the SAC, thus preventing any direct disturbance from cable installation on any of the features of the SAC. Therefore, only temporary impacts from anchor handing or similar ancillary works have the potential to overlap with the Thanet Coast SAC. Furthermore, it should be noted that part of the cable exclusion zone overlaps with the dredged channel for the approach to Ramsgate Harbour.

11.2.68 Given the absence of the sublittoral chalk reef feature within the footprint of the project, combined with the Biogenic Reef Mitigation Plan referred to in Table 6.1, there is no potential for disturbance to any chalk reef feature should any cable repair or reburial be required. Furthermore, the only potential impacts on the Thanet Coast SAC arise from non-licenceable activities such as anchor delpoyments from vessels due to the changes to the RLB and the cable exclusion area. In addition, should any maintenance be required along the length of the OECC that falls within (or in close proximity to) the Thanet Coast SAC, appropriate measures would be taken to ensure no loss of any chalk reef feature, with these to be determined in relation to the required works and the results of any surveys undertaken at the time.

11.2.69 There will, therefore, be no temporary disturbance of the designated feature 'chalk reef' for the Thanet Coast SAC during operation or maintenance and, therefore, there is no AEoI to the chalk reef feature of the Thanet Coast SAC in relation to temporary disturbance from Thanet Extension alone and therefore, subject to natural change, the chalk reef feature will be maintained in the long-term.

Thanet Coast and Sandwich Bay SPA

11.2.70 The potential for temporary disturbance will occur during O&M within the intertidal habitats, which are comprised of saltmarsh and the mudflat foreshore. These habitats are potential roosting and feeding habitats for designated bird species within the Thanet Coast and Sandwich Bay SPA.

11.2.71 No substantive maintenance is expected to be required to the intertidal cables, with maintenance expected to comprise of inspections, including geophysical investigations, involving persons on foot or using a small 4 wheel drive. The assessment during construction and decommissioning identified these habitats to generally have low sensitivity to disturbance.

11.2.72 Saltmarsh is common throughout Pegwell Bay and is present throughout the study area, including further south towards Sandwich Bay. Given that the intertidal habitats are common and widespread throughout the region, the area directly affected represents a very small footprint compared to their overall extent. Further, through discussion within the Evidence Plan (12th July 2017), it has been confirmed that the saltmarsh is, in areas around the proposed landfall, well established *Spartina* and as such, less diverse than the patchier *Salicornia* saltmarsh to the north, in proximity to the hoverport. Such saltmarsh is considered of lower quality and lesser importance for birds than the habitat found further north around the hoverport (Evidence Plan meeting - 26th May 2017). It is also of note that a section of the area immediately adjacent to the Country Park, and therefore the location of the proposed landfall, is above MHW and as such characterised by areas of reed and grass rather than high value saltmarsh.

11.2.73 As described above, the mudflat foreshore is characterised by species that show rapid recovery to disturbance.

11.2.74 Within the ES assessment (Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5)), the magnitude of the impact to the saltmarsh and foreshore has been assessed as low, with the sensitivity of the receptor assessed as medium. Therefore, the significance of the effect from the temporary disturbance of the intertidal foreshore is assessed as minor, which is not significant in EIA terms.

11.2.75 The conservation objectives for the SPA require maintenance of the extent and distribution, together with the structure and function of the habitats of the qualifying features. Although the operational stage of Thanet Extension will result in a small area of saltmarsh and intertidal foreshore being temporarily disturbed during maintenance, this represents a very small proportion of the overall habitat, in an area known to be less diverse and of lower quality when compared to the areas of saltmarsh present within the wider area and consisting of mudflat foreshore characterised by species that show rapid recovery to disturbance. Combined with the conclusion of minor significance within the ES, it is considered that the potential for temporary disturbance of the intertidal foreshore which may result from maintenance activities, if required, would be short-term and temporary and would therefore not be significant in terms of the site.

11.2.76 There is, therefore, no AEoI to the intertidal habitats used by the designated ruddy turnstone and European golden plover features of the Thanet Coast and Sandwich Bay SPA in relation to temporary disturbance during O&M from Thanet Extension alone and therefore, subject to natural change, the designated features will be maintained in the long-term with respect to the potential for effect from temporary disturbance.

Thanet Coast and Sandwich Bay Ramsar

11.2.77 The potential for temporary disturbance will occur during O&M within the intertidal habitats, which are comprised of saltmarsh and the mudflat foreshore. These habitats are included as intertidal habitats for designated species within the Thanet Coast and Sandwich Bay Ramsar. The potential for an effect on ruddy turnstone is assessed above as part of the consideration of the Thanet Coast and Sandwich Bay SPA; that assessment applies equally to the ruddy turnstone feature of the Thanet Coast and Sandwich Bay Ramsar and is therefore not repeated here.

11.2.78 Although there are no conservation objectives for the Ramsar, the SPA does, with these considered here and referenced above. Although the operational stage of Thanet Extension will result in a small area of saltmarsh and intertidal foreshore being temporarily disturbed during maintenance, this represents a very small proportion of the overall habitat, in an area known to be less diverse and of lower quality when compared to the areas of saltmarsh present within the wider area and consisting of mudflat foreshore characterised by species that show rapid recovery to disturbance. Combined with the conclusion of minor significance within the ES, it is considered that the potential for temporary disturbance of the intertidal foreshore which may result from maintenance activities, if required, would be short-term and temporary and would therefore not be significant in terms of the site.

11.2.79 There is, therefore, no AEoI to the intertidal habitats used by the designated ruddy turnstone feature of the Thanet Coast and Sandwich Bay Ramsar in relation to temporary disturbance during O&M from Thanet Extension alone and therefore, subject to natural change, the feature will be maintained in the long-term with respect to the potential for effect from temporary disturbance.

11.2.80 As set out in respect of temporary habitat loss/ disturbance during construction, although the possible presence of *Orthotylus rubidus* cannot be conclusively ruled out, it is not likely to be present within the area that would be affected by planned O&M works.

11.2.81 In the unlikely event that *Orthotylus rubidus*, or potentially suitable habitat for *Orthotylus rubidus*, is present within the area that could be affected by planned O&M works, embedded mitigation will be implemented to avoid impacts on it. Embedded mitigation measures will be detailed in a TIMS, which will be informed by a detailed invertebrate survey of affected areas. The precise selection of measures to be employed would depend on the results of the survey and the final design solution adopted, although at this stage it is considered likely that the measures relevant to *Orthotylus rubidus*, if present, during planned O&M works would be limited to the avoidance of suitable habitat. Areas of suitable habitat for *Orthotylus rubidus*, if present, are likely to be relatively small and therefore readily avoided during planned O&M works. The TIMS will form part of the detailed LEMP, which will be subject to agreement with the relevant planning authorities, in consultation with Natural England and other relevant stakeholders, prior to construction commencing. Further details are provided in the Outline LEMP (Document Ref. 8.7).

11.2.82 Although there are no published conservation objectives for the Ramsar site it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Given the very low chance that *Orthotylus rubidus* is present within the affected area and following the implementation of the embedded mitigation, the assumed conservation objectives will not be compromised. In respect of temporary loss or disturbance to intertidal habitats during planned O&M works there is therefore no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site from Thanet Extension alone.

Increased suspended sediment and associated deposition

11.2.83 The potential for an AEoI as a result of increased SSC and associated deposition on subtidal and benthic intertidal habitats during O&M relates to the following designated sites and the relevant feature (i.e. those features screened in for LSE):

- Thanet coast SAC;
  - Chalk reefs.
- Margate and Long Sands SAC;

- Sand banks which are slightly covered by sea water all the time.

- Thanet Coast & Sandwich Bay SPA; and
  - Intertidal habitats used by ruddy turnstone (Non-breeding); and
  - Intertidal habitats used by European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar.
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates; and
  - Ramsar Criterion 6 – Intertidal habitats used by species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

11.2.84 For both the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar sites, the potential for AEoI relevant to intertidal habitats arises from the potential effect on intertidal habitats.

11.2.85 Minor amounts of sediment may be released into suspension, with subsequent deposition, during the O&M phase, for example should cable repairs be required or resulting from scour. However, the degree of sediment disturbance and any resulting increase in SSC and subsequent deposition will be much reduced when compared to the construction phase.

Thanet Coast SAC

11.2.86 The magnitude of the impact during construction, which will be greater than any impact during the O&M phase, has been assessed within the ES as regards subtidal ecology (Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5)) as low, with the maximum sensitivity of the receptors being medium. Furthermore, the post-construction surveys undertaken for TOWF identified that changes in faunal composition between pre- and post-construction were only as a result of natural variation, suggesting no long-term impacts from increased SSC or increased sediment deposition (MESL, 2013). The significance of effect from changes in SSC and associated sediment deposition occurring as a result of O&M activities will be at most the same as during cable installation activities and will therefore at most be minor, which is not significant in EIA terms.

11.2.87 Although impacts are predicted to be low, there is potential for sediment released to reach the Annex I habitat (chalk reef) qualifying feature of the Thanet Coast SAC. The Regulation 33 document for the North East Kent Coast EMS[80] (which includes the Thanet Coast SAC) finds the following in relation to the chalk reefs and siltation:

'The communities found on the reefs around Thanet are however, naturally tolerant of a degree of siltation due to the relatively high sediment load in the water column. Because of this, the reefs of the Thanet coastline are considered to be of a low sensitivity to physical damage through siltation.'

11.2.88 It is therefore considered that, given the short-term and temporary nature of any such change, the existing levels of SSC in the area, the ES conclusion of minor, the lack of AEoI during construction (when potential for effect is much greater) and the known low sensitivity of the chalk reef feature to siltation, it is concluded that the sites conservation objectives will be maintained in the long-term. There is, therefore, no AEoI to the chalk reef feature of the Thanet Coast SAC in relation to increased SSC and associated deposition from Thanet Extension alone during O&M and therefore, subject to natural change, the chalk reef feature will be maintained in the long-term.

Margate and Long Sands SAC

11.2.89 The magnitude of the impact during construction, which will be greater than any impact during the O&M phase, has been assessed within the ES as regards subtidal ecology (Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5)) as low, with the maximum sensitivity of the receptors being medium. Furthermore, the post-construction surveys undertaken for TOWF identified that changes in faunal composition between pre- and post-construction were only as a result of natural variation, suggesting no long-term impacts from increased SSC or increased sediment deposition (MESL, 2013). The significance of effect from changes in SSC and associated sediment deposition occurring as a result of O&M activities will be at most the same as during cable installation activities and will therefore at most be minor, which is not significant in EIA terms.

[80] http://publications.naturalengland.org.uk/file/3229392

11.2.90 Although impacts are predicted to be low, there is potential for the sediment released to reach the Annex I habitat (sand banks which are slightly covered by sea water all the time) qualifying feature of the Margate and Long Sands SAC. The array boundary for Thanet Extension is approximately 3 km from the boundary of the SAC and therefore beyond the 560 m range for 0.05 m deposition highlighted in the ES (Volume 2, Chapter 5: Benthic Subtidal and Intertidal Ecology (Application Ref 6.2.5)). Any short-term and temporary increase in SSC levels that reaches the SAC boundary will be reduced from the nearfield maximum, together with a reduced potential for deposition.

11.2.91 The Regulation 35 Advice on Activities for the SAC[81] considers the vulnerability of the site to non-toxic contamination, specifically an increase in turbidity, concluding a low vulnerability (vulnerability being a function of sensitivity and exposure).

11.2.92 Given the short-term and temporary nature of the effect, combined with the existing SSC levels in the region, the lack of long-term impacts found following the construction of the TOWF and the lack of AEoI during construction (when potential for effect is much greater), it is concluded that the sites conservation objectives will be maintained in the long-term. There is, therefore, no AEoI to the sand banks which are slightly covered by sea water all the time feature of the Margate and Long Sands SAC in relation to increased SSC and associated deposition from Thanet Extension alone during O&M and therefore, subject to natural change, the feature sand banks which are slightly covered by sea water all the time will be maintained in the long-term.

Thanet Coast and Sandwich Bay SPA

11.2.93 The species and habitats identified during the intertidal characterisation surveys (LS.LSa.FiSa, LS.LSa.MuSa.CerPo and LS.LSa.MuSa) are typical of the wider region of the surrounding area. All three biotopes have been assessed according to the MarLIN and MarESA criteria as having a high recoverability to changes in SSC, high recoverability to 'light' sediment deposition (5 cm) and a high to medium recoverability to 'heavy' sediment deposition (> 5 cm).

11.2.94 In addition, the intertidal zone of Pegwell Bay within the landfall area is an accretion zone, with sediment received from natural supplies including updrift, offshore and fluvial sources. While sands and silts are transported into Pegwell Bay on tidal currents, the majority of sediment transport occurs during storm surge events, with shingle movement, flattening of areas and berm creation in others. Therefore, the habitats identified within the landfall area will likely have a low intolerance to these impacts.

11.2.95 Within the ES, the magnitude of the impact during construction, which will be greater than any impact during the O&M phase, has been assessed as low, with the maximum sensitivity of the receptors being medium. Therefore, the significance of effect from changes in SSC and associated sediment deposition in the intertidal area occurring as a result of O&M activities will be at most the same as during cable installation activities and will therefore at most be minor, which is not significant in EIA terms.

11.2.96 Given the habitats are naturally accreting and increases to SSCs will be local and rapidly attenuate to natural levels, the conservation objectives for the Thanet Coast and Sandwich Bay SPA, which require the integrity of the site to be maintained or restored, by maintaining or restoring the extent and distribution of the habitats of the qualifying species and overall structure and function of the habitats, will not be compromised.

11.2.97 There is, therefore, no AEoI to the intertidal habitats used by the designated features of the Thanet Coast and Sandwich Bay SPA in relation to the short-term and temporary increased suspended sediments and deposition effects from Thanet Extension alone during O&M and therefore, subject to natural change, the intertidal habitats will be maintained in the long-term with respect to the potential for effect from an increase in SSC and subsequent deposition.

Thanet Coast and Sandwich Bay Ramsar

11.2.98 The potential for an increase in suspended sediment and subsequent deposition to affect the Thanet Coast and Sandwich Bay Ramsar is equal to that assessed for the SPA, with that text not repeated here, particularly given that, in the absence of conservation objectives for the Ramsar, those applied to the SPA are considered here. Given the habitats are naturally accreting and increases to SSCs will be local and rapidly attenuate to natural levels, the conservation objectives for the Thanet Coast and Sandwich Bay SPA, which require the integrity of the site to be maintained or restored, by maintaining or restoring the extent and distribution of the habitats of the qualifying species and overall structure and function of the habitats, will not be compromised.

11.2.99 There is, therefore, no AEoI to the intertidal habitats used by the designated bird feature (ruddy turnstone) of the Thanet Coast and Sandwich Bay Ramsar in relation to the short-term and temporary increased suspended sediments and deposition effects from Thanet Extension alone during O&M and therefore, subject to natural change, the intertidal habitats will be maintained in the long-term with respect to the potential for effect from an increase in SSC and subsequent deposition.

[81] http://publications.naturalengland.org.uk/file/3271272

11.2.100 As described in relation to construction, the wetland invertebrate assemblage species *Orthotylus rubidus* is not likely to be affected by increases in SSCs, even if present.

11.2.101 Although there are no published conservation objectives for the Ramsar site it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. The degree of sediment disturbance and any resulting increase in SSC and subsequent deposition due to planned O&M works will be much reduced when compared to the construction phase. Given that suitable habitat for *Orthotylus rubidus* is very unlikely to be affected by increases in SSCs in any event, the assumed conservation objectives are not likely to be compromised. With respect to potential effects resulting from an increase in SSC and subsequent deposition during the O&M phase there is therefore no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site from Thanet Extension alone.

Change to physical processes

11.2.102 The potential for an AEoI as a result of a change in physical processes on subtidal and benthic intertidal habitats during O&M relates to the following designated sites and the relevant features (i.e. those features screened in for LSE):

- Thanet coast SAC;
  - Chalk reefs.
- Margate and Long Sands SAC;
  - Sand banks which are slightly covered by sea water all the time.

11.2.103 In the subtidal, the presence of foundations, scour protection and cable protection material may introduce changes to the local hydrodynamic and wave regime, resulting in changes to the sediment transport pathways and associated effects on benthic ecology. Scour and increases in flow rates can change the characteristics of the sediment potentially making the habitat less suitable for some species.

11.2.104 The ES (Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2)) has determined that the potential for impacts on physical processes will be negligible to minor, with any such impacts being localised and of short to medium term duration.

11.2.105 Any such localised and minor change in physical processes will have a negligible risk for subtidal habitats, including the relevant features of the Thanet Coast SAC (chalk reefs) and Margate and Long Sands SAC (sand banks which are slightly covered by sea water all the time), and the conservation objectives will therefore be maintained in the long-term. There is, therefore, no AEoI to the designated features of these sites in relation to the negligible risk of a change in physical processes from Thanet Extension alone during O&M and therefore, subject to natural change, the relevant features will be maintained in the long-term.

11.3 Marine Mammals

11.3.1 A description of the significance of project level effects upon the receptors grouped under 'marine mammals', as relevant to the designated sites and their associated features screened in for LSE, is provided below. All designated sites screened in, including the features and effects for which potential for LSE has been concluded, are summarised in Table 7.3.

Construction and Decommissioning

Accidental Pollution (construction and decommissioning)

11.3.2 The potential for an AEoI as a result of accidental pollution on marine mammals during construction and decommissioning relates to the following designated site and the relevant feature (i.e. those features screened in for LSE). The potential for LSE during decommissioning would be similar to and potentially less than those outlined in the construction phase.

- Southern North Sea cSAC/SCI (harbour porpoise); and
- Bancs des Flandres SCI (harbour porpoise, harbour seal and grey seal).

11.3.3 The potential for accidental pollution to affect marine mammals was not considered in the ES (Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7), given the inclusion of the following in the project specific mitigation able (Table 7.15) :

'A Project Environmental Management Plan (PEMP) will be produced and followed to cover the construction and O&M phases. This will also incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. MMO, Maritime and Coastguard Agency (MCA) and the project site co-ordinator). A decommissioning programme will be developed to cover the decommissioning phase. The purpose of the measures to be implemented ensure that potential for contaminant release is strictly controlled and therefore provides protection to marine life across all phases of the life of the project.'

11.3.4 The implementation of the PEMP, produced in consultation with Natural England and provided for in the DCO as part of the standard dML requirements, enables the conclusion that there is, therefore, no AEoI to the marine mammals in relation to accidental pollution from Thanet Extension alone and therefore, subject to natural change, the marine mammal features will be maintained in the long term with respect to the potential for accidental pollution.

Increase in underwater noise (construction)

11.3.5 The following assessment is in relation to the potential for effect during construction only. The Screening Report (Annex 1, Application Ref 5.2.1) and subsequent updates (section 7) determined that the potential for LSE in relation to underwater noise during decommissioning would be similar to and potentially less than those outlined in the construction phase. LSE resulting from underwater noise has been screened out of LSE for the O&M phase.

11.3.6 The potential for an increase in underwater noise during construction to result in an AEoI relates to the following designated sites and the relecvant features:

- Southern North Sea cSAC/SCI (harbour porpoise);
- Bancs des Flandres SCI (harbour porpoise, harbour seal and grey seal);
- Baie de Canche et couloir des trois estuaires (harbour seal, grey seal);
- Vlakte van de Raan (harbour seal, grey seal);
- Voordelta (harbour seal, grey seal);
- Estuaires et littoral picards (baies de Somme et d'Authie) (harbour seal, grey seal);
- Recifs Gris-Nez Blanc-Nez (harbour seal, grey seal);
- Vlaamse Banken (harbour seal, grey seal);
- SBZ 1 (grey seal);
- SBZ 2 (grey seal);
- SBZ 3 (grey seal); and
- Ridens et dunes hydrauliques (grey seal and harbour seal).

11.3.7 The location of these designated sites, in relation to Thanet Extension, is shown in Figure 11.1. Detail on why transboundary sites have been screened out of assessment, based on the 26km EDR, is provided for in section 7.5.

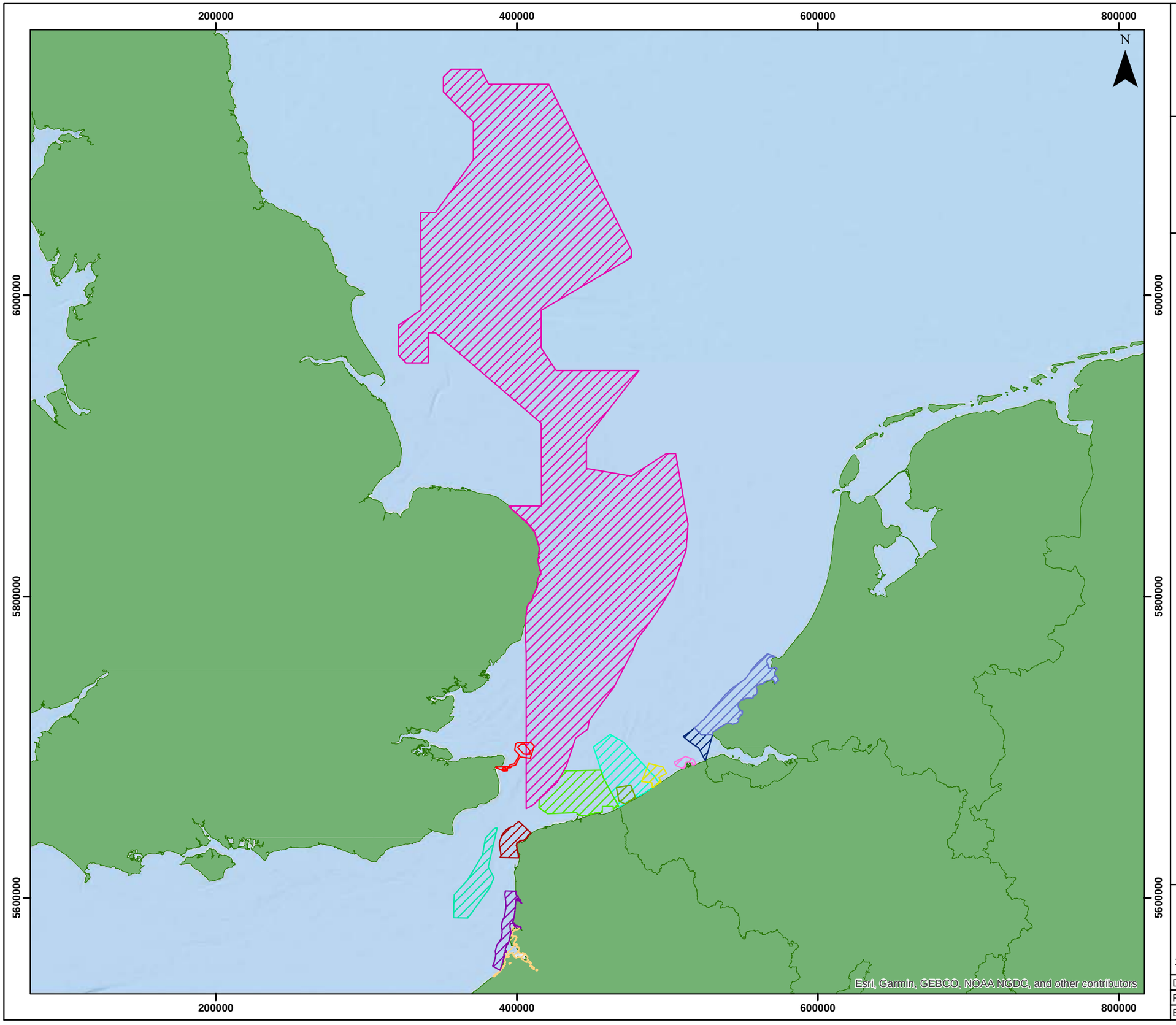

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Figure 11.1

Sites Identified for Marine Mammals in Relation to Thanet Extension

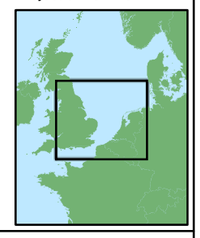
Legend

- Offshore Red Line Boundary

Identified Designated Sites

- Baie de Canche et couloir des trois estuaires
- Bancs des Flandres
- Estuaires et littoral picards (baies de Somme et d'Authie)
- Ridens et dunes hydrauliques du détroit du Pas-de-Calais
- Récifs Gris-Nez Blanc-Nez
- SBZ 1 / ZPS 1
- SBZ 2 / ZPS 2
- SBZ 3 / ZPS 3
- Southern North Sea
- Vlaamse Banken
- Vlakte van de Raan
- Voordelta

Datum: ETRS 1989
Projection: UTM31N



1:2,500,000 0 25 50 km 0 10 20 nm

Drg No	Fig11.1_MarineMammalsSites		
Rev	0.1	Date	01/02/2019
By	RM	Layout	N/A

Figure 11.1

11.3.8 There are a number of sources of underwater noise associated with the project alone during construction, with these identified within Volume 2, Chapter 7: Marine Mammal (Application Ref 6.2.7):

- Clearance of unexploded ordinance (UXO);
- Pile-driving during the installation of foundations for WTGs, OSS (if required) and met mast (if required);
- Vessel activity; and
- Seabed preparation for both WTG, OSS, met mast and cable installation (e.g. dredging) and other activities in relation to cable installation (such as rock dumping and trenching).

11.3.9 In addition to these, should they be required by the project, there is potential for underwater sound to be generated during geophysical or seismic survey and should Acoustic Deterrent Devices (ADDs) be used as mitigation.

11.3.10 The importance of underwater noise for marine mammals (including harbour porpoise, harbour seal and grey seal) is discussed in Volume 2, Chapter 7: Marine Mammal (Application Ref 6.2.7). That information, together with the underwater noise that may result from the above activities (as discussed in Volume 4, Annex 6-3: Underwater Noise (Application Ref 6.4.6.3)) and how that may affect marine mammals in the context of the conservation objectives for each relevant designated site, is drawn on here, with each of these effects discussed in turn below, including the relevance for the relevant features identified.

UXO Clearance

11.3.11 Experience from other OWF projects in the southern North Sea, together with the experience of the Nemo interconnector project, suggests that there is the potential for UXO to occur within the array and OECC for Thanet Extension and that it is likely that UXO clearance work may be required in some cases; this would need to be confirmed by site specific surveys. It should be noted that the preferred action for VWPL is for no UXO clearance to occur; however, should UXO be detected during the pre-construction geophysical survey, clearance (including a detonation option) may be required prior to construction as a safety measure. Any required UXO clearance would take place before construction piling commences, with the proposed date for such clearance being from 2019 (but more likely to be 2020). UXO clearance will not occur on the same day but could occur within the same season as piling or geophysical survey at Thanet Extension.

11.3.12 It is not possible at this stage to accurately predict the number of UXO that would require clearance. Experience suggests that the number of targets encountered can be significant, but that the number which prove positive and actually require detonation is limited. Experience from other offshore wind projects within the southern North Sea suggests that, on average, around 20 *in situ* detonations may be expected – however, a precautionary assumption of 30 is being made here. UXO clearance is expected to occur during daylight hours only, with the potential for multiple clearances to occur within a day (provided relevant thresholds are not exceeded), thus limiting the overall duration of the work. It is anticipated that up to 8 detonations could occur within a single 24 hour period (noting up to 4 per day, totalling up to 8 per 24 hopurs if clearance occurs on 2 consequative days), with approximately 7.5 days of work in total (based on an average of 4 clearances per day) or up to 30 days maximum.

11.3.13 The potential for impact would therefore be expected to relate to a series of up to 30 controlled explosions across the project area and OECC, resulting in a series of discrete, single sources of underwater noise. As noted above, the location(s) of any such UXO have yet to be identified; the final location of any UXO requiring clearance will influence the potential for disturbance within a designated site, notably for harbour porpoise where a 26 km EDR is relevant. The consideration here draws on Volume 2 Chapter 7: Marine Mammals of the ES, which includes consideration of underwater noise modelling for UXO (applying the 2016 NOAA thresholds).

11.3.14 UXO clearance for UXO up to 130 kg (if required) would be included within a Marine Licence and/ or with an EPS Licence application to follow as requried. It is standard practice for a condition to be attached to any such licences requiring a UXO-MMMP to be in place as part of the required mitigation, to ensure that the risk of lethal and injurious effects is kept as low as feasible, with the works meeting the required EPS tests[82]. Furthermore, it should be noted that in the JNCC guidance for minimising the risk of injury to marine mammals from explosives[83], that mitigation measures implemented through a UXO-MMMP are focused on the prevention of injury rather than disturbance. For activities that make use of explosions for a relatively short period of time (such as clearance of UXO), the JNCC guidance notes that there is a low likelihood of disturbance occurring that could be sufficient to lead to an offence. From this, it can be seen that the UXO-MMMP that would be required (and agreed with SNCBs) would provide mitigation to ensure that the risk of injury is as low as possible, meeting the requirements of EPS licensing (namely the three tests – IROPI, alternatives and FCS), with the risk of disturbance considered to be extremely low.

11.3.15 The UXO-MMMP will ensure that an appropriately sized mitigation zone is applied around each location (where *in situ* explosion is required) together with appropriate detection and/ or deterrent measures if required (in line with the JNCC, 2010 guidance together with more recent advice and best practice). The mitigation will minimise the risk that marine mammals (including harbour porpoise, harbour seal and grey seal) would be within the zone of potential lethal and injurious effects (noting that PTS is defined as an injury), and prior to detonations being carried out. The EDR for UXO is 26km, with Thanet Extension being at least 229 km distant from the summer extents of the SNS cSAC/SCI – and therefore any UXO clearances conducted within the summer season would not be screened in for consideration within the RIAA. The draft UXO-MMMP, if required, will be developed in consultation with the statutory advisors together with the associated EPS Licence application should the need for UXO clearance arise.

11.3.16 It should be noted that Volume 2, Chapter 7: Marine Mammal (Application Ref 6.2.7) specifically considered the risk of PTS in marine mammals as a result of UXO clearance, finding that based on the onset range for PTS (unweighted) approximately 11 harbour porpoise could potentially be at risk of PTS (less than 0.01% of the reference population) and less than one individual harbour or grey seal. The assessment noted significant uncertainty in the models and the likelihood that the numbers were overestimates. The level of effect was found to be minor and therefore not significant.

Consideration of Harbour Porpoise for RIAA Purposes

11.3.17 Given that the proposed MMMP (Application Ref 8.11) will provide for appropriate mitigation to minimise the risk of injury or mortality in harbour porpoise during percussive piling, and that a UXO-MMMP would be implemented (with prior approval by the regulator) for the same purpose prior to any UXO clearance, it is concluded that Thanet Extension alone does not have an AEoI on the viability of harbour porpoise as a result of mortality or injury resulting from UXO clearance within the designated sites identified above (including the SNS cSAC/SCI and Bancs des Flandres SCI) and therefore ensures that, subject to natural change, harbour porpoise will be maintained as a 'viable component' of the sites in the long-term with respect to the potential for mortality and injury.

11.3.18 With respect to the second harbour porpoise conservation objective, the requirement is to determine the potential for significant disturbance within the SNS cSAC/SCI and the Bancs des Flandres SCI.

11.3.19 For harbour porpoise, an EDR of 26 km can be applied when considering the potential for disturbance from an individual UXO clearance. Since the array boundary is approximately 229 km from the summer extents of the SNS cSAC/SCI, any UXO detonation occurring during the summer season would not have any effect on that conservation objective. For any UXO clearance within the winter season, the maximum overlap per individual UXO clearance with the SNS cSAC/SCI would be 1,308 km^2 (10.31% of the winter component) (see Figure 11.2). As a worst-case (assuming multiple detonations within 24 hours, with up to 8 per day, within a 7.5 day window, to a maximum of 30), the maximum possible overlap in a single 24 hour period would be 1,503 km^2 (11.85% of the winter component). The calculation is based on a worst possible case, which would only arise should three detonations occur at the edge of the array and one at the edge of the OECC (four detonations in total). No other combination (in terms of number or locations) of detonations within a single 24 hour period could result in a larger spatial effect and therefore the 20% threshold within a single day will not be exceeded (even if multiple UXO clearances were to occur within a single 24 hour period and within the winter season).

[82] http://publications.naturalengland.org.uk/file/8499055

[83] http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Explosives%20Guidelines_August%202010.pdf

11.3.20 For the transboundary site, the maximum area of overlap for the Bancs des Flandres SCI would be 43 km^2 (3.34% of the SCI). Further, it is clear from Figure 11.2 that UXO clearance would need to occur within a small proportion of Thanet Extension array boundary to result in such spatial overlap. As for the SNS cSAC/SCI, the 20% threshold within a single day would not be exceeded.

11.3.21 The anticipated duration of UXO clearance would take an estimated 7.5 days (provided 30 detonations are required and assuming four detonations per day, up to a maximum of eight per day). For assessment purposes, as a temporal worst-case, it could be assumed that the slowest rate of detonations would require 30 days (i.e. one per day). For the 10% averaged across a season, although there is potential for 10% within a single day to be exceeded, the effect would be for a very short duration (days to weeks). For the SNS cSAC/SCI (for which the seasonal effect would be greater than Bancs des Flandres), and assuming a single clearance per day for 30 days of the winter season, the seasonally averaged value is 1.70%. The value decreases significantly should the faster rate of clearance be applied (assuming four clearances per day, taking 7.5 days), being 0.52%. Therefore, when averaged across six months, the anticipated level of UXO clearance would not exceed the 10% threshold for either the SNS cSAC/SCI or the Bancs des Flandres SCI. It is also apparent that if required (and taking account of in-combination effects) there would be capacity for additional UXO clearances to occur and for the 20% daily and 10% seasonal thresholds to be met.

11.3.22 Therefore, it is concluded with confidence that there will not be an AEoI in relation to disturbance on the Conservation Objective for harbour porpoise for the SNS cSAC/SCI or the Bancs des Flandres SCI as a result of UXO clearance from Thanet Extension alone and therefore, subject to natural change, in the long-term, there will be no significant disturbance of harbour porpoise.

Table 11.1: Spatial Extent of Disturbance associated with UXO Clearance within the Designated Sites

Designated Site	Potential Effect from UXO Clearance	
	Area of effect (km^2)	% of site (winter seasonal component)
Single UXO Clearance		
SNS cSAC/SCI	Max: 1,308 km^2 Min: 119 km^2	Max: 10.31% (winter extents) Min: 0.94% (winter extents)
Bancs des Flandres SCI	Max: 43 km^2 Min: 0 km^2	Max: 3.34% (total SCI) Min: 0% (total SCI)
Maximum UXO clearance in 24 hours*		
SNS cSAC/SCI	Max: 1,503 km^2	Max: 11.85% (winter extents)
Bancs des Flandres SCI	Max: 43 km^2	Max: 3.34% (total SCI)

* 4 UXO clearances within 24 hours would represent the worst-case in terms of spatial extent, with no other number or location combinations of UXO clearances resulting in a larger spatial extent of effect

11.3.23 The third conservation objective is focused on maintaining the availability and density of suitable harbour porpoise prey within the cSAC and SCI. For harbour porpoise, as noted in section 9, the habitat of the prey referred to is in relation to the characteristics of the seabed and water column, in terms of, for example stable stratified waters, current speed, the particle size of the sediment etc. There is no evidence of a pathway to link underwater noise to the seabed and water column characteristics referred to in the Conservation Objective. Even if such a pathway were to exist, the potential for Thanet Extension as a whole to affect the seabed and water column in terms of the water depth and water column variables referred to in the description of the sites Conservation Objectives has been assessed within the relevant chapters of the Thanet Extension ES application (Volume 2, Chapter 2, Application Ref 6.2.2), with the conclusions for all potential impacts throughout the chapter being not significant.

11.3.24 There is, therefore, no AEoI to the supporting habitats and processes relevant to harbour porpoise and their prey for the SNS cSAC/SCI or the Bancs des Flandres SCI from Thanet Extension alone and therefore, subject to natural change, the availability and density of suitable harbour porpoise prey will be maintained in the long-term.

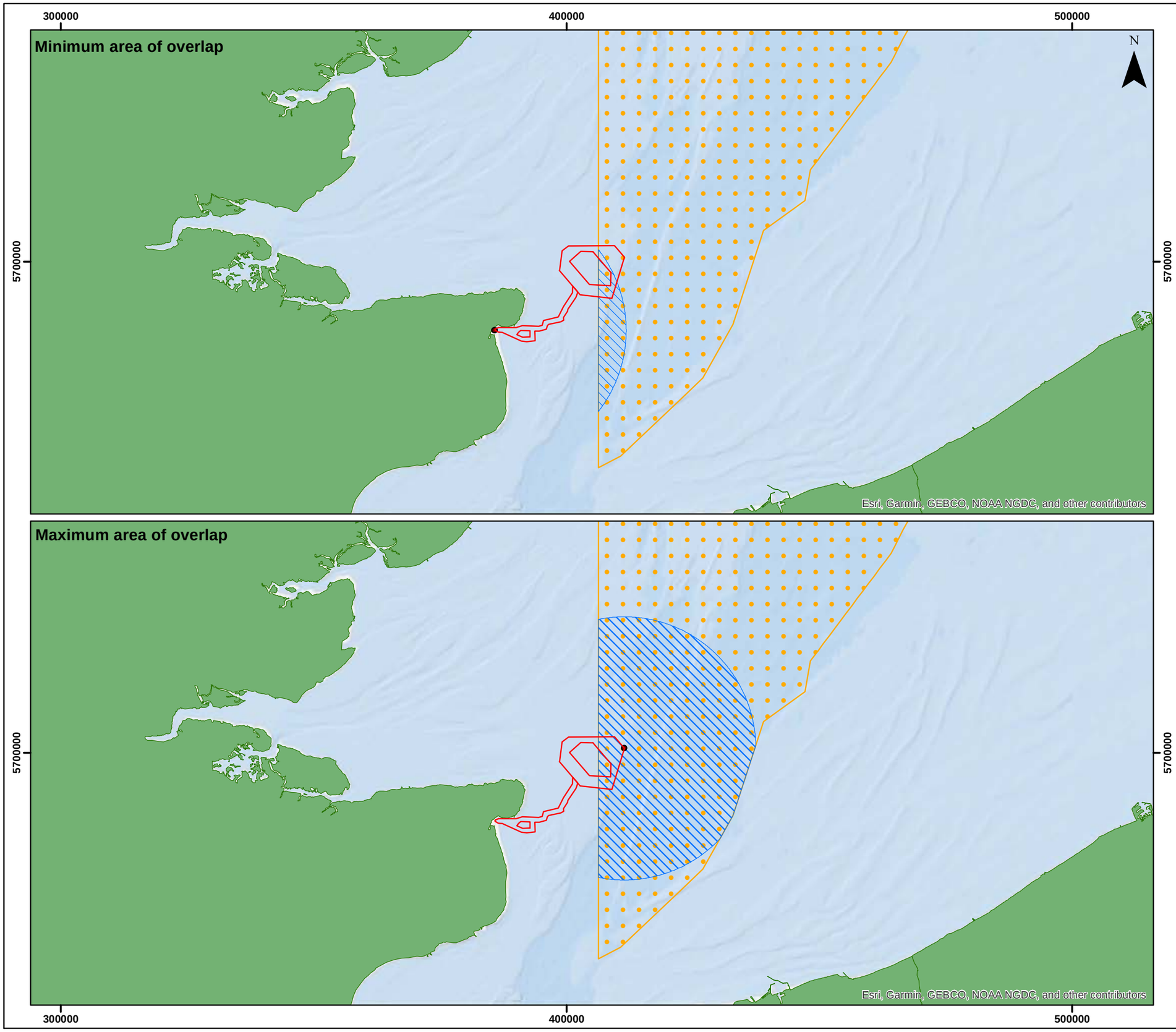


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Figure 11.2

Maximum and Minimum Areas of Overlap with the SNS cSAC as a Result of UXO Detonation

Legend

- Southern North Sea cSAC
- Offshore Red Line Boundary
- UXO Detonation
- Area of Overlap from a Single UXO Detonation

Datum: ETRS 1989
Projection: UTM31N

1:750,000 0 8 16 km 0 4.5 9 nm

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Rev	0.1	Date	01/02/2019
By	RM	Layout	N/A

Figure 11.2

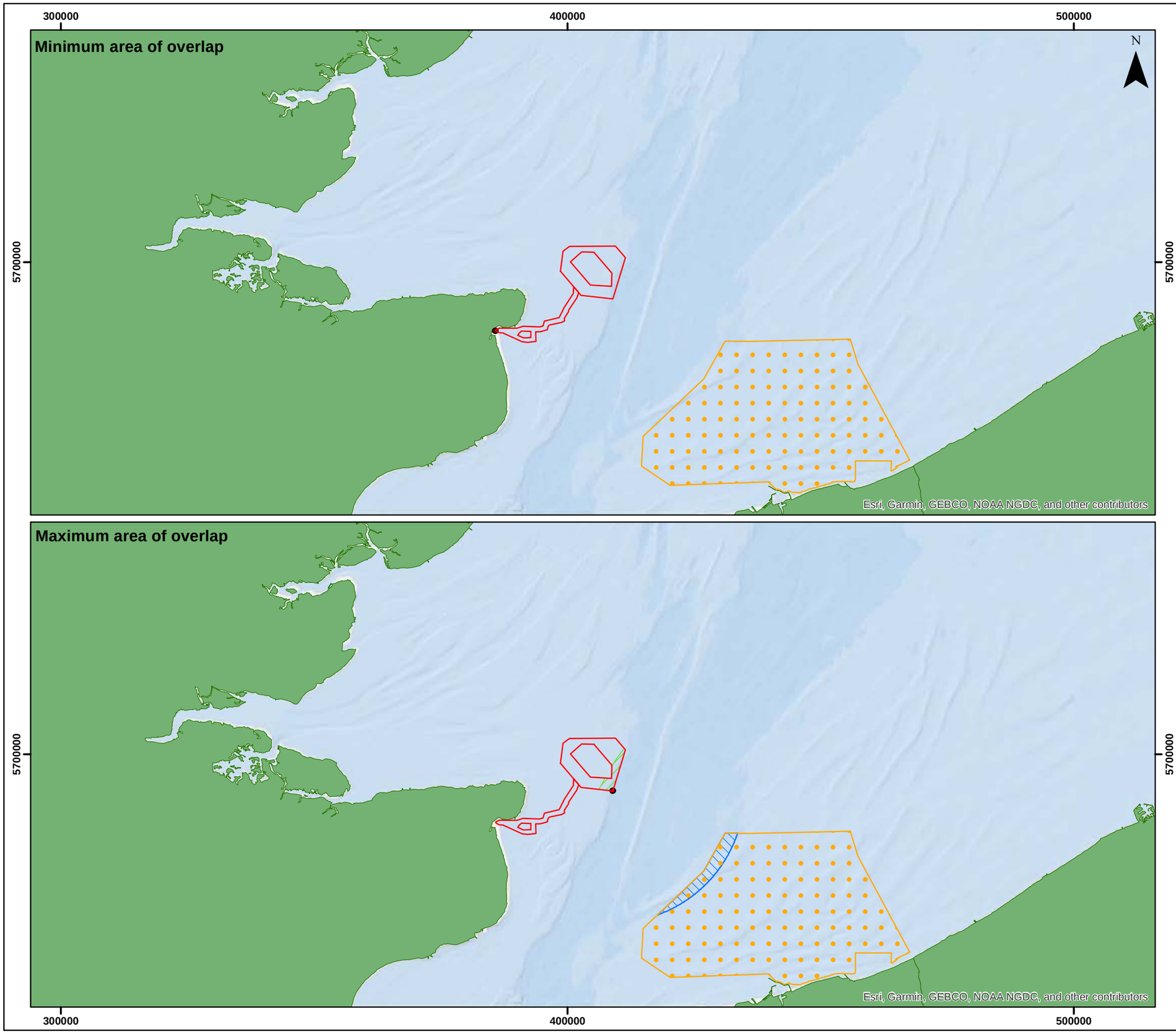

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Figure 11.3

Maximum and Minimum Areas of Overlap with the Bancs de Flandres SCI as a Result of a Single UXO Detonation

Legend

- Offshore Red Line Boundary
- Bancs de Flandres SCI
- UXO Detonation
- Area of Overlap with the Bancs de Flandres SCI
- Area of overlap between Development Boundary and a 26 km buffer from the Bancs de Flandres SCI - Only UXO detonation within this area would result in an effect

Datum: ETRS 1989
Projection: UTM31N

1:750,000 0 8 16 km 0 4.5 9 nm

Drg No	Fig11.3_BancsdeFlanUXO		
Rev	0.1	Date	01/02/2019
By	RM	Layout	N/A

Figure 11.3

Consideration of Harbour Seal and Grey Seal for RIAA Purposes

11.3.25 The conservation status for harbour seal and grey seals requires that the species will be 'maintaining itself on a long-term basis as a viable component of its natural habitat'. As for harbour porpoise above, the implementation of a UXO-MMMP, if required, would minimise the risk of injury or mortality in harbour seal and grey seal, and therefore ensure that the viability of the species associated with the transboundary designated sites identified above as a result of mortality or injury will be maintained. As such, the population dynamics of the species will not be affected on a long-term basis and the conservation status will not be affected.

11.3.26 Therefore, it is concluded with confidence that there will not be an AEoI on the conservation status of harbour seal and grey seal in relation to viability as a result of UXO clearance from Thanet Extension alone and therefore ensure that, subject to natural change, in the long-term, the viability of harbour seal and grey seal will be maintained with respect to injury and mortality.

11.3.27 For harbour seals and grey seals, the second requirement for FCS is for 'the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future', a requirement analogous to the significant disturbance requirement for harbour porpoise. Therefore, for harbour seal and grey seal associated with transboundary sites (located between 23 km and 117 km from Thanet Extension), it is reasonable to consider the extent and duration of potential disturbance in terms of the overall available habitat. Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7) identifies the study area for seals in section 7.4, for harbour seals being the South-east England MU (IAMMWG 2013) and for grey seals the South-east England, North-east England and Scottish east coast MUs (IAMMWG 2013).

11.3.28 For harbour seal and grey seal, the pertinent points are the distance between Thanet Extension and each transboundary site, the overall extent of available habitat and the short-term and temporary nature of the UXO clearance. These combine to enable a conclusion that the natural range of the species as a result of UXO clearance at Thanet Extension will not be reduced for the foreseeable future.

11.3.29 Therefore, it is concluded with confidence that there will not be an AEoI in relation to disturbance on the conservation status for harbour seal and grey seal as a result of UXO clearance from Thanet Extension alone and therefore ensure that, subject to natural change, in the long-term, there will be no significant disturbance of harbour seal or grey seal.

11.3.30 For harbour seal and grey seal, the third measure of conservation status relates to there being a sufficiently large habitat to maintain the population on a long-term basis. The UXO clearance will be short-term and temporary, within a very small proportion of the overall available habitat. The extent of physical habitat available will not be affected and therefore the conservation status will similarly remain unaffected.

11.3.31 There is, therefore, no AEoI on the extent of harbour seal and grey seal habitat from Thanet Extension alone and therefore, subject to natural change, the extent of harbour seal and grey seal habitat will be maintained in the long-term.

Percussive piling

11.3.32 The maximum adverse scenario for marine mammals (Table 12.1: In-combination projects and maximum design scenario) included percussive piling during the installation of the foundation structures, for WTGs, the OSS (if required) and the met mast (if required). There will be a maximum number of 36 foundations in total (34 WTGs, 1 OSS and 1 met mast). Should these be installed on monopiles, they would require a single pile per foundation. The duration of piling per monopile is an anticipated maximum of six hours (including 60 minutes of soft start together with set up time), resulting in total anticipated piling time of 216 hours or nine days, spread across an overall piling window of six months. Should each foundation be installed on quadropod jacket foundations, the duration of piling per foundation would necessarily increase, since up to four piles would be required per foundation. The result would be an anticipated maximum piling time of eight hours per foundation, with an anticipated maximum piling time of 288 hours or approximately twelve days, spread across an overall piling window of six months.

11.3.33 Project specific mitigation specifically included for pile driving is identified in Table 6.1 and includes the following:

- Marine Mammal Mitigation Plan – following the 2010 JNCC guidelines, a MMMP will be produced and followed to cover the construction phase, including measures deemed necessary to reduce to negligible the potential risk of injury or death to marine mammals in close proximity to piling operations; and
- Soft start – an hour of soft start piling during which the hammer energy will gradually be ramped up to full power applied to all piling activities.

11.3.34 In addition, there is the potential for Acoustic Deterrent Devices (ADDs), together with Marine Mammal Observers (MMOb) and Passive Acoustic Monitoring (PAM), to be included as mitigation within the MMMP.

11.3.35 Underwater noise during construction of Thanet Extension has been studied specifically through the following, including that of direct relevance to marine mammals:

- Volume 4, Annex 6-3: Underwater noise assessment (Application Ref 6.4.6.3); and
- Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7).

11.3.36 The 2017 Subacoustech report provides the technical evidence base for underwater noise, with the ES chapter providing the context for marine mammals (specifically harbour porpoise, harbour seal and grey seal), in relation to the potential for lethal and physical injury. Auditory injury is addressed in the ES through consideration of Permanent Threshold Shift (PTS). The threshold values applied for PTS are as follows (with the background to the various thresholds provided in section 7.11 of Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7) of the ES):

Table 11.2: Threshold values for determining PTS impact ranges for marine mammal impact assessment (NMFS, 2016)

	National Marine Fisheries Service (2016)[#]	
	$SPL_{z\text{-}p(flat)}$ (dB re 1 µPa)	**$SEL_{(HG)}$ (dB re 1 µPa²s)**
HF Cetacean (harbour porpoise)	202	155
Pinnipeds (harbour and grey seal)	218	185

Metrics are unweighted or flat weighted (flat), M weighted according to National Marine Fisheries Service (2016)(HG) with regard to the species' hearing group.

[#] Typically referred to as the 'NOAA threshold'

11.3.37 The noise modelling for lethal and non-auditory impact range during piling of monopile foundations (assuming 100% blow energy of the 5,000 kJ hammer) was undertaken at an easterly and south west location within the array, with the impact range for marine mammals for lethal injury being 3 – 4 m. For a non-auditory injury, the impact ranges increased slightly to a maximum of 53 m, with the ES finding that:

'As a result of the establishment of mitigation zones through the MMMP, as well as the amount of pre-piling vessel activity, there should be no marine mammals within a few metres of the pile. Therefore, there is no potential for any [lethal or non-auditory injury] effect'

11.3.38 The assessment within the ES presents the information on PTS (i.e. auditory injury) in both harbour porpoise and for seals, providing the information both as 'instantaneous' PTS, but also as a cumulative PTS, the latter calculated to take account of prolonged exposure over the whole piling event. The ES found that for instantaneous PTS, the modelled impact ranges in both harbour porpoise (up to 660 m (monopile) or 450 m (pin pile) at full hammer energy) and seals (up to 70 m (monopile) or 48m (pin pile) at full hammer energy). It is therefore apparent that there is an extremely low risk of an instantaneous PTS in any harbour porpoise or seal beyond 700m.

11.3.39 Despite significant uncertainty associated with a cumulative exposure estimate, potential impact ranges have been calculated within the ES, being up to just 30 m for seals (monopiles and pin piles) and up to 960 m for harbour porpoise (the latter relating to pin piles only – for monopiles, the range was significantly less at 60 m). The potential for exposure to noise levels that could cause PTS over the whole piling sequence can therefore be reduced by ensuring the mitigation zone extends out to the maximum range (across all species) predicted, namely 960 m, bearing in mind that such a level would apply to pin piles only. The ES considers disturbance in harbour porpoise and seals through two assessment methods. These are a fixed threshold assessment and a dose response assessment. Full details on these methods are provided in the ES (Section 7.11, Volume 2, Chapter 7: Marine Mammals (Application Ref 6.7.2)), but effectively the fixed threshold method assumes a fixed area of effect and a fixed population density throughout that area, whereas the dose response applies a known rate of reduction in harbour porpoise density with distance, together with the change in sound over that distance. The ranges calculated for harbour porpoise for the fixed threshold assessment are 16.8 - 28.4 km, with these ranges (based on mean population density estimates obtained from SCANS III84) equating to between 0.17% and 0.47% of the reference population. The value compares favourably to that concluded from the harbour porpoise dose response analysis, namely 0.23 - 0.54% of the same reference population. It should be noted that the measure of possible avoidance applied in the ES (namely possible avoidance or an 'aversive behavioural reaction' and not necessarily displacement) is stronger than that represented by the EDR of 26 km, which is a measure of overall habitat loss.

[84] https://synergy.st-andrews.ac.uk/scans3/

11.3.40 The ES concluded the following for the dose response analysis disturbance (displacement) in harbour porpoise:

*'the effects are considered to be temporary and reversible, affecting only a small proportion of the relevant MUs, and the magnitude of the impact is assessed as **low**. Given that harbour porpoises have a **medium** sensitivity to the impact of potential avoidance this results in a **minor significance**, which is **not significant** in EIA terms.'*

11.3.41 For seals, a dose response analysis has been applied for behaviour. This results in a prediction of between 5.2 and 15.8 harbour seals and between 3.0 and 6.1 grey seals potentially experiencing noise levels high enough to elicit a behavioural response. This equates to between 0.07% and 0.22% of the reference population for harbour seals and between 0.01 and 0.02% of the UK reference population for grey seals.

11.3.42 The ES concluded the following for the behavioural dose response analysis in seals:

'the effects are considered to be temporary and reversible, affecting only a small proportion of the relevant management units, and the magnitude of this impact is assessed as low. Given that harbour have a medium sensitivity and grey seals have a low sensitivity to the effect of potential avoidance this results in a minor significance, which is not significant in EIA terms.'

Consideration of Harbour Porpoise for RIAA Purposes

11.3.43 To determine the potential for AEoI with respect to harbour porpoise (within both the SNS cSAC/SCI and the more distant Bancs des Flandres SCI), the first conservation objective to test is that 'the species is a viable component of the site'. The intent of this Conservation Objective is to minimise the risk posed by activities to species viability.

11.3.44 The status of harbour porpoise as a EPS is referred to within the SNS cSAC/SCI literature, in relation to defining the viability of the species. The listing of harbour porpoise under Annex IV of the Habitats Directive, means that the species is protected from deliberate killing (or injury), capture and disturbance throughout its range; in essence, the requirements for EPS protection broadly mirror those for consideration of viability (with the exception of 'capture', which does not apply to offshore wind, and without the non-deliberate element, which is included within Article 12 (4) of the Habitats Directive).

11.3.45 Initial consideration of harbour porpoise, as an EPS, is given within the Marine Mammal chapter of the ES, in the context of the general discussion of the potential for impact. The ES identified that if the risk of injury or significant disturbance cannot be reduced to negligible levels with mitigation, then an EPS licence is required.

11.3.46 The above project literature is drawn on here to demonstrate the potential for viability in harbour porpoise to be affected as a result of the underwater noise generated during percussive piling. The assessment is relevant primarily for the SNS cSAC/SCI, given the proximity of Thanet Extension to the SNS cSAC/SCI (being partially within), but also the Bancs des Flandres SCI, with the logical expectation that any potential for AEoI on that more distant site would be less than at the SNS cSAC/SCI.

11.3.47 The conclusions of the ES referred to above regarding the potential spatial extent of lethal, non-auditory impact and PTS (all being within the proposed mitigation zone of 960 m) found that the proposed MMMP (Application Ref 8.11) (as provided for in the DCO as part of the standard dML requirements and following consultation and approval with relevant statutory authorities) will provide for appropriate mitigation to minimise to negligible the risk of injury or mortality in harbour porpoise during percussive piling.

11.3.48 Following the implementation of the MMMP, it is concluded that Thanet Extension alone does not have an AEoI on the viability of harbour porpoise as a result of mortality or injury within the SNS cSAC/SCI and therefore cannot have an AEoI on the more distant Bancs des Flandres SCI. It can therefore be concluded that, subject to natural change, harbour porpoise will be maintained as a 'viable component' of the sites in the long-term with respect to the potential for mortality and injury. The disturbance aspect of viability is discussed below, as part of the second conservation objective.

11.3.49 The second conservation objective in relation to the SNS cSAC/SCI and the Bancs des Flandres SCI relates to significant disturbance within the site(s), the aim being to ensure that any resulting displacement is not significant in terms of extent and duration. The worst-case consequence of such disturbance is that harbour porpoise may be displaced from the area affected, essentially preventing access to an area of designated habitat during periods of such noisy activity.

11.3.50 Thanet Extension has undertaken detailed underwater noise modelling to support the characterisation of disturbance to harbour porpoise features in response to exposure to underwater piling activity (as presented in section 7.11 of Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7) of the ES). The conclusion of the ES assessment for a behavioural response to underwater noise during construction as a result of Thanet Extension alone is a determination of minor adverse significance, which is not significant in EIA terms.

11.3.51 As identified above, unless project specific evidence indicates otherwise, and rather than revert to individual Projects' noise modelling predictions made within respective Environmental Statements, the SNCBs have advised that a more uniform, generic approach, based on observed harbour porpoise behavioural evidence, be adopted for the disturbance assumptions when characterising significant disturbance effects (i.e., displacement) of the harbour porpoise cSAC feature, specifically the 26 km EDR.

11.3.52 The result of applying the EDR is to understand the potential temporary habitat loss as a result of displacement around each individual foundation location. If all the footprint fell inside the SNS cSAC/SCI, this would equate to approximately 2,124 km^2 (essentially the area within a circle with a radius of 26 km). The actual area of displacement at each foundation will (assuming the range is applied equally in all directions) depend on the location of that foundation relative to the cSAC boundary but also the season within which piling occurs. For example, given the location of Thanet Extension array area (being only partially within the SNS cSAC/SCI and being at least 23 km from the Bancs des Flandres SCI), some of the effect radius will fall outside the cSAC/ SCI boundary (or for the SNS cSAC/SCI the relevant seasonal component), resulting in a maximum possible displacement extent per foundation that for Thanet Extension will always be less than the potential maximum.

11.3.53 For the purposes of the assessment, the OSS and met mast (if required) have been considered to be additional foundations. Should piling occur at more than one foundation location within a single 24 hour period (although piling will be limited to that undertaken by a single piling rig), the potential for effect will be considered conservatively in that the footprint of disturbance within that 24 hour period would be the combined footprint from each foundation location (based on the EDR), excluding any area of overlap (to avoid double counting) and excluding consideration of any temporal delay.

11.3.54 The point at which a given level of possible displacement is considered significant in relation to the Conservation Objective (regardless of the noise source that leads to the displacement and as expressed in terms of area affected (in km^2)), has also been determined and agreed with SNCBs. The established threshold seeks to ensure 80% availability of habitat at any one time (defined as a 24 hour period) and 90% availability of habitat on average over the season (relevant to summer and winter components of the cSAC). Therefore, for an AEoI to occur within the SNS cSAC/SCI, displacement of harbour porpoise would need to exceed 20% of the seasonal component of the cSAC at any one time (i.e. within any one 24 hour period), and/ or on average exceed 10% of the seasonal component of the cSAC over the duration of that season. For the Bancs des Flandres SCI, the determination has been applied to the whole site (there is no known seasonal differentiation across the site).

11.3.55 Table 11.3 below summarises the maximum and minimum area of overlap that could occur by the EDR as a result of piling at Thanet Extension at the SNS cSAC/SCI and Bancs des Flanders SCI respectively (in both km^2 and %). It should be noted that for the SNS cSAC/SCI, the minimum distance between the array boundary and the summer seasonal component is 229 km – therefore, for operations within the summer season, there can be no spatial effect within the cSAC. The information for the SNS cSAC/SCI is presented in relation to the winter period only.

Table 11.3: Spatial Extent of Disturbance within the Designated Sites

Designated Site	Potential Effect from Percussive piling	
	Area of effect (km^2)	% of site/ winter seasonal component
Single foundation location in a 24 hour period		
SNS cSAC/SCI	Max: 1,308 km^2 Min: 669 km^2	Max: 10.31% (winter extents) Min: 5.27% (winter extents)
Bancs des Flandres SCI	Max: 43 km^2 Min: 0 km^2	Max: 3.34% (total SCI) Min: 0% (total SCI)
Maximum foundation locations in a 24 hour period*		
SNS cSAC/SCI	Max: 1,485 km^2 Min: 725 km^2	Max: 11.71% (winter extents) Min: 5.74% (winter extents)
Bancs des Flandres SCI	Max: 43 km^2 Min: 0 km^2	Max: 3.34% (total SCI) Min: 0% (total SCI)

*The number of foundations that may be installed within a 24 hour period will depend on a number of factors, not least the fact that a single piling rig will be deployed which provides a practical limit in itself to the number of foundations that would technically be feasible in that timeframe. However, it is feasible that piling could occur at more than one foundation location within a 24 hour period, the combined footprint from which being subject to numerous variables, namely the location(s) chosen. To enable a maximum spatial extent to be calculated that is representative of all possible variables, a worst-case from a combined number of foundation locations has been calculated (with no other combination or number of locations resulting in a larger spatial effect). That assumption is for piling to occur at up to four foundation locations within a 24 hour period (while acknowledging that such a rate of installation is likely to be greater than that which is technically feasible – however the approach allows for the variables mentioned above).

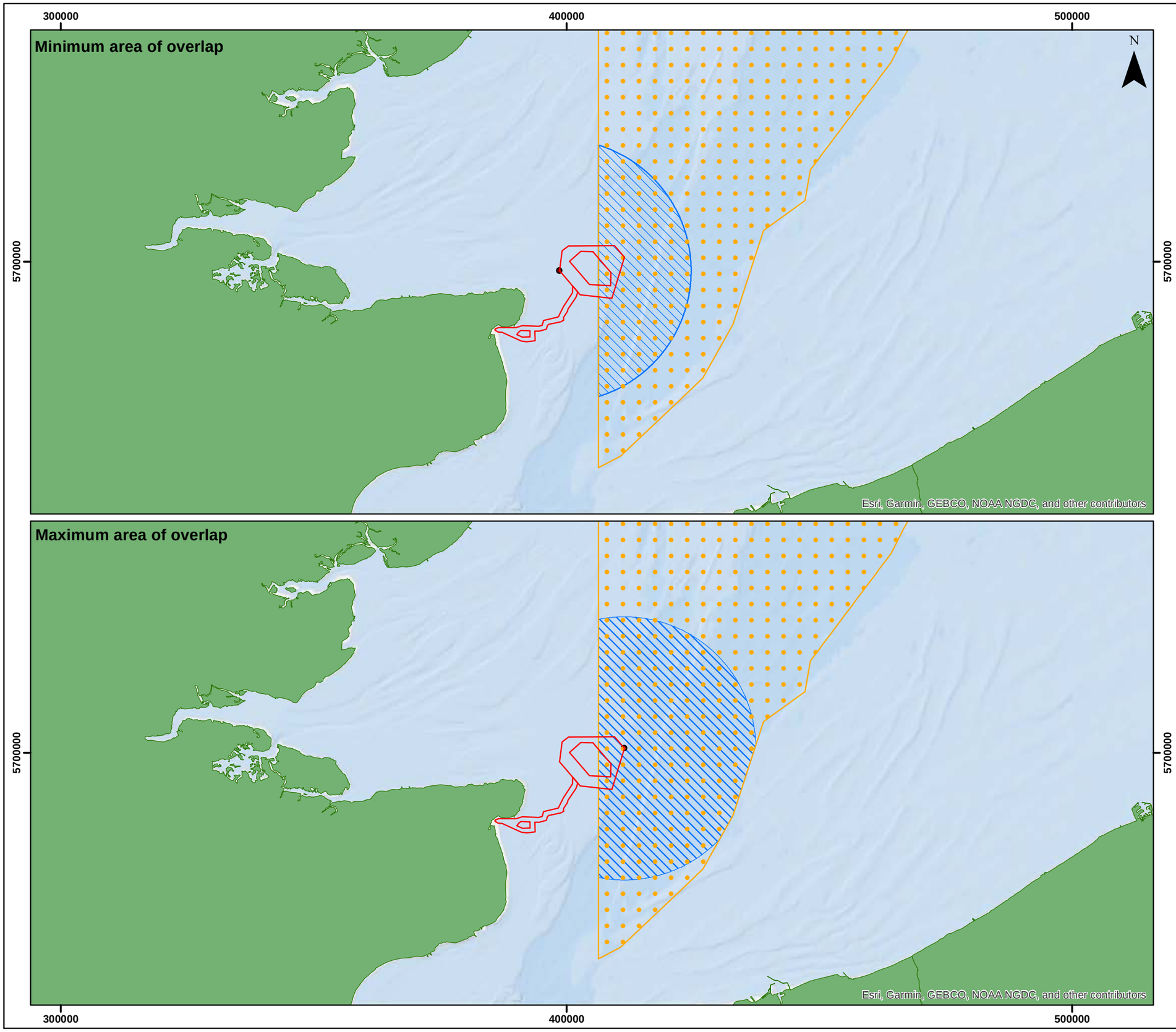

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Figure 11.4

Maximum and Minimum Areas of Overlap with the SNS cSAC as a Result of a Single Piling Event

Legend

- Offshore Red Line Boundary
- Southern North Sea cSAC
- Foundation Location
- Area of Overlap with the SNS cSAC

Datum: ETRS 1989
Projection: UTM31N

1:750,000 0 8 16 km 0 4.5 9 nm

Drg No	Fig11.4_SNScSACPiling		
Rev	0.1	Date	01/02/2019
By	RM	Layout	N/A

Figure 11.4

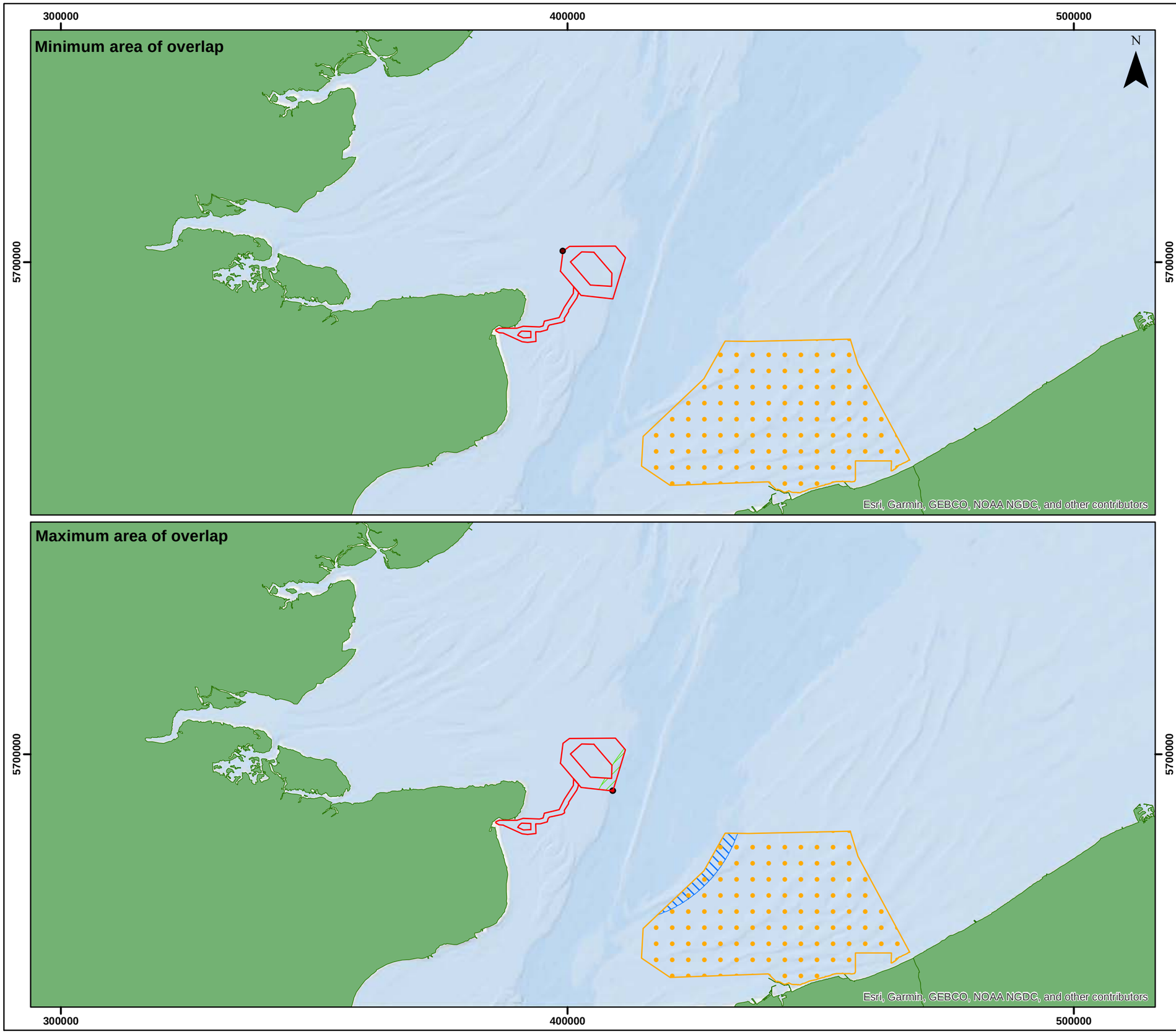

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Figure 11.5

Maximum and Minimum Areas of Overlap with the Bancs de Flandres SCI as a Result of a Single Piling Event

Legend

- Bancs de Flandres SCI
- Offshore Red Line Boundary
- Foundation Location
- Area of Overlap with the Bancs de Flandres SCI
- Area of overlap between Development Boundary and a 26 km buffer from the Bancs de Flandres SCI - Only piling within this area would result in an effect

Datum: ETRS 1989
Projection: UTM31N

1:750,000 0 8 16 km 0 4.5 9 nm

Drg No	Fig11.5_BancsdeFlanPiling			**Figure 11.5**
Rev	0.1	Date	01/02/2019	
By	RM	Layout	N/A	

11.3.56 With respect to the SNS cSAC/SCI and for Thanet Extension alone during the winter season only, no foundation piling scenario will result in a spatial effect greater than 20% within a single 24 hour period, reaching 11.71% as a maximum (based on the maximum piling scenario identified in Table 11.3). Therefore, the maximum value of 20% in any given day at the SNS cSAC/SCI will not be exceeded by piling at Thanet Extension alone under any circumstance.

11.3.57 As regards the Bancs des Flandres SCI for Thanet Extension alone, no foundation piling will result in a spatial effect greater than 20% within a single 24 hour period, reaching 3.83% as a maximum. Therefore, the maximum value of 20% in any given day will not be exceeded by piling at Thanet Extension alone under any circumstance. Further, it is apparent from Figure 11.5 that only foundations installed within a small proportion of the array boundary would result in a spatial overlap with the Bancs des Flandres SCI.

11.3.58 The temporal aspect of the threshold (10% across the season) equates to all the piling anticipated to occur within a single season. The overall piling window for Thanet Extension falls across three calendar years (Q1 2021-Q2 2023, however piling will only occur within a six month period within the larger window, although the total duration of piling (including a 60 minute soft start per pile) would only take up to approximately nine days, which would be spread across that window, if all foundations were installed on monopiles and twelve days if all were installed on quadropod jacket foundations. It is not yet determined if that six month period will fall wholly within a single season, or straddle more than one, although given the distance between Thanet Extension and the summer seasonal component, any piling within the summer season will not contribute to the seasonal total of 10%, with only piling that occurs during the winter season to be included for assessment purposes here.

11.3.59 Although the maximum spatial extent of effect that could occur within a single day exceeds 10% (being up to 11.71% for the maximum piling scenario within a single 24 hour period), such a rate of piling would require all foundations to be installed within a nine day period and not be spread across the full six months. Such a concentrated rate of installation would ensure that although on a given day, the extent of spatial disturbance could exceed 10% (but not the daily 20% threshold), the short-term nature of such an effect would, when averaged across the season (of 182 days for the winter season) be approximately 0.58% and therefore would not exceed the 10% value. Should piling installation occur at the slowest rate possible (i.e. a maximum of one foundation per day, requiring 36 days of piling within the 182 day winter period), the potential for effect (which would be at most 10.31% in a given day) would average across the season to 2.04%, well below the 10% seasonal limit.

11.3.60 For the Bancs des Flandres, the maximum spatial extent of disturbance (which would only occur as a result of piling in a limited extent of the Thanet Extension array boundary) would be up to 3.34% in a single day and therefore, when averaged across a season, there is no possibility of the 10% seasonal limit being exceeded.

11.3.61 It is also recognised that it is important to consider return time within the assessments, with evidence suggesting that this may range from a few hours (less than a day – Tougaard *et al*. 2009, Brandt *et al*. 2012, Dahne *et al*. 2013), up to 3 days (Diederichs *et al*. 2009, Brandt *et al*. 2011), between 'a few hours' to 'between one and three days' (Tougaard *et al*. (2014)) to more precise values of 12 hours (e.g. van Beest *et al*., 2015) and that the timing of return may vary with distance from noise source and also quality of habitat (i.e. motivation to return) (Brandt *et al*., 2016). The approximate maximum total duration of piling activity (including the soft start) is presented in Table 5.2: Maximum project design scenario

11.3.62 as 9-12 days (depending on the pile type), which would be spread across the overall piling window of 6 months. It is therefore apparent that within the overall piling window, considerable opportunity for return time exists.

11.3.63 Specifically, if piling of individual monopiles takes an assumed maximum of 6 hours per pile, assuming a single monopile were installed within a 24 hour period, there would be 18 hours of non-piling time, allowing a measure of return time (depending on the number of foundations installed within that period), or around 16 hours potential return time for quadropod jacket foundations, assuming an individual foundation installed within that 24 hour period. There is therefore, considerable return time within each 24 hour period built into the assessment. Should a faster rate of piling occur (ie more foundations per 24 hours), the total number of days within which piling would occur would be reduced, freeing up additional days within the overall piling window for return.

11.3.64 The above assessments of the various piling construction scenarios clearly demonstrate that under no circumstance will any piling scenario exceed the daily maximum or seasonal average at the SNS cSAC/SCI or the Bancs des Flandres SCI. Therefore, it is concluded with confidence that there will not be an AEoI of the Conservation Objective as a result of piling related disturbance from Thanet Extension alone and therefore ensure that, subject to natural change, in the long-term, there will be no significant disturbance of harbour porpoise.

11.3.65 The third conservation objective is focused on maintaining the availability and density of suitable harbour porpoise prey within the SNS cSAC/SCI or Bancs des Flandres SCI. The habitat of the prey referred to is in relation to the characteristics of the seabed and water column, in terms of, for example stable stratified waters, current speed, the particle size of the sediment etc. There is no evidence of a pathway to link underwater noise to the seabed and water column characteristics referred to in the Conservation Objective. Even if such a pathway were to exist, the potential for Thanet Extension as a whole to affect the seabed and water column in terms of the water depth and water column variables referred to in the description of the sites Conservation Objectives has been assessed within the relevant chapters of the Thanet Extension ES application (see Volume 2, Chapter 2, Application Ref 6.2.2), with the conclusions for all potential impacts throughout the chapter being not significant.

11.3.66 There is, therefore, no AEoI to the supporting habitats and processes relevant to harbour porpoise and their prey from Thanet Extension alone and therefore ensure that, subject to natural change, the availability and density of suitable harbour porpoise prey will be maintained in the long-term.

Consideration of Harbour Seal and Grey Seal for RIAA Purposes

11.3.67 To determine the potential for AEoI with respect to harbour seal and grey seal within the transboundary sites screened in, consideration is first given to the definition of favourable conservation status being applied as a proxy in the absence of any available conservation objectives for these sites. The following is therefore relevant:

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

11.3.68 The nearest site designated for harbour or grey seals is the Bancs des Flandres SCI, some 23 km distant. The remaining transboundary sites are located at increasing distances from Thanet Extension, up to 107 km from the array boundary. The potential for piling noise during construction to affect the conservation status of harbour and grey seals through the above parameters is analogous to that assessed for UXO clearance, albeit piling will occur intermittently over a longer duration (up to six months, with total piling time within that window being 9-12 days).

11.3.69 To mitigate against the potential for lethal or injurious effects, i.e. the viability component, as for UXO clearance a MMMP will be required, enforced through the DCO and so requiring consultation and agreement with statutory bodies. The mitigation will include the 960 m mitigation zone referred to above, thus avoiding the potential to affect the viability of the species.

11.3.70 The ES (Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7)) considers the potential for disturbance in harbour and grey seals during piling. It is disturbance that could temporarily affect the natural range of the species, if that disturbance were sufficient to result in avoidance of areas for a sustained period. The ES found that the maximum number of seals that could elicit a behavioural response during piling (at the maximum hammer energy) would be between 5.2 and 15.8 harbour seals and between 3.0 and 6.1 grey seals. This equates to 0.07 - 0.22% of the UK reference population plus the Wadden Sea population for harbour seals and 0.01-0.02% for grey seals. Actual piling duration, as noted above, will depend on the foundation type chosen but will equate to between 9 and 12 days of piling activity within a 6 month window. Such a level of disturbance, which will be temporary, intermittent and short-term, is not considered sufficient to result in an adverse effect on the natural range of the species in the long-term, particularly given the small proportion of the population affected.

11.3.71 The final measure of conservation status is the availability of sufficiently large habitat. For harbour seal and grey seal, the piling will be temporary and intermittent and within a very small area of the overall available habitat (the small proportion of the population that may be affected indicating the lack of importance of the area in the context of the population and the overall habitat). The extent of physical habitat available will not be affected and therefore the conservation status will remain unaffected.

11.3.72 There is, therefore, no AEoI to the harbour seal and grey seal features of the transboundary sites site in relation to underwater noise associated with piling effects from Thanet Extension alone and therefore, subject to natural change, harbour seal and grey seal will not be affected in the long-term with respect to the potential for underwater piling noise.

Increased vessel traffic

11.3.73 The potential for vessel related disturbance on marine mammals alone has been assessed within the existing project literature (see section 7.11 and 7.12 of Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7)).

11.3.74 Underwater noise associated with vessel traffic during construction has the potential to result in disturbance of marine mammals. Disturbance from vessel noise is only likely to occur, however, where increased noise from vessel movements associated with the construction of Thanet Extension is greater than the background ambient noise. The outer Thames Estuary is a busy shipping area; therefore, background noise levels are likely to be high.

11.3.75 Detailed information on the baseline levels of vessel activity in the vicinity of Thanet Extension is provided in Volume 2, Chapter 10: Shipping and Navigation (Application Ref 6.2.10). Commercial shipping traffic lanes are located within 5 nm of the site, with traffic through the boundaries of Thanet Extension area boundary occurring at a rate of approximately 328 commercial vessel passages per month and many hundreds more occurring around the site boundaries. A Gate Analysis presented in Volume 2, Chapter 10: Shipping and Navigation, assessed the frequency and distribution of traffic flow within nearby shipping routes. Transit rates were up to between 10 and 30 transits per day. These shipping routes are mainly occupied by large commercial cargo vessels, fishing vessels and tankers. As a result, any marine mammals in the vicinity of the site are likely to be habituated to a large volume of ship traffic. The maximum number of construction vessels anticipated on site at any one time is 48, with an average of 29. This is not considered to be a significant increase in total vessel movements. In addition, existing commercial shipping traffic lanes will likely be rerouted to outside of the Thanet Extension boundary, therefore numbers of vessel movements within the boundary of the site will actually decrease as a result of construction and operation resulting in a reduced amount of exposure to vessel noise within the site boundaries.

11.3.76 Comment on shipping effects on harbour porpoise is provided in the SNS cSAC/SCI Selection Assessment Document (Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7)), which found the following in relation to the probability of harbour porpoise presence and density:

'There was a negative relationship with increasing levels of traffic beyond a threshold of approximately 80 ships per day'

11.3.77 Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7) of the ES found that there is very little published information on the responses of seals at sea to vessel noise. Jones *et al*. (2017) presents an analysis of the predicted co-occurrence of ships and seals at sea which demonstrates that UK wide there is a large degree of predicted co-occurrence between ships and seals at sea, particularly within 50 km of the coast close to seal haul haul-outs. There is no evidence relating decreasing seal populations with high levels of co-occurrence between ships and animals and areas where seal populations are increasing (e.g. south-east England) and where ship co-occurrences are highest, are experiencing the highest levels of growth (Jones *et al*. 2017).

11.3.78 The ES concluded that the impact of noise disturbance from vessels is predicted to be of local spatial extent, short-term duration and reversible, with a low magnitude for all marine mammal species. Given the proximity of shipping channels and the use of the site by other vessels, it is likely that marine mammals using this area are habituated to this type of underwater noise. The sensitivity for all marine mammal species is determined in the ES as being low. The effect was therefore concluded to be of minor significance, which is not significant in EIA terms.

Consideration of Harbour Porpoise for RIAA Purposes

11.3.79 The existing vessel traffic movements within the array boundary (up to 10-30 per day), combined with the average increase in vessel numbers per day (29 and up to 48 as a maximum, the latter considered unlikely as construction activities will be staggered), remains below the approximately 80 movements per day found within Volume 1, Chapter 4: Site Selection and Alternatives (Document 6.1.4) to have a negative effect on harbour porpoise. When considering the existing shipping levels, it should be noted that the Shipping and Navigation Chapter (Volume 2 Chapter 10) assumes that, as a worst-case, all existing shipping currently passing through Thanet Extension boundary would take alterantive routes.

11.3.80 As noted above, the relevant conservation objectives for harbour porpoise are to ensure that, subject to natural change, the following attributes are maintained or restored in the long-term:

- The species is a viable component of the site.
- There is no significant disturbance of the species.
- The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.

11.3.81 The viability component specifically relates to activities that kill, injure or significantly disturb harbour porpoise, although the disturbance element can be considered within the second conservation objective. The marine mammal chapter of the ES (Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7)) limited consideration of underwater noise in relation to vessel traffic to the potential for disturbance; underwater noise from vessel traffic is insufficient to result in mortality or injury in marine mammals.

11.3.82 The second conservation objective relates to significant disturbance. However, given the existing level of vessel activity within the region, combined with the relatively small increase in vessel numbers, it can be concluded that the construction of Thanet Extension will not significantly increase existing levels of disturbance for harbour porpoise within the SNS cSAC/SCI (and therefore can have no significant effect on the geographically more distant site of Bancs des Flandres).

11.3.83 The third conservation objective is focused on maintaining the availability and density of suitable harbour porpoise prey within the cSAC. The habitat of the prey referred to is in relation to the characteristics of the seabed and water column. There is no evidence of a pathway to link underwater noise to the seabed and water column characteristics referred to in the conservation objective. The relevance of the conservation objective for Thanet Extension therefore stems from the potential for underwater noise to have an adverse effect on harbour porpoise prey that live within these habitats. The HRA Screening Report (Annex 1, Application Ref 5.2.1) and subsequent updates (section 7) concluded no potential for LSE in relation to a change in prey availability and behaviour for harbour porpoise.

11.3.84 There will therefore be no AEoI to the harbour porpoise feature of the SNS cSAC/SCI of the Bancs des Flandres SCI in relation to vessel disturbance during construction from Thanet Extension alone and therefore, subject to natural change, the harbour porpoise feature will be maintained in the long-term.

Consideration of Harbour Seal and Grey Seal for RIAA Purposes

11.3.85 As noted in section 9, the definition of favourable conservation status is being applied for harbour seal and grey seal in relation to the transboundary sites screened in. This is defined as follows:

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

11.3.86 As concluded for the viability aspect for harbour porpoise, underwater noise from vessel traffic is insufficient to result in mortality or injury in marine mammals. The potential for disturbance of harbour and grey seals can similarly be concluded to be not significant, given the existing levels of shipping and the lack of evidence linking a reduction in seal populations to shipping. As regards the natural range of harbour seal and grey seals, it should be noted that the screening range for such sites is significant (120 km for harbour seals and 145 km for grey seals), with the closest transboundary site screened in being some 23 km distant. The Marine Mammals Chaper to the ES (Volume 2, Chapter 7) found, based on typical construction vessel frequencies, that harbour and grey seal would be expected to detect such vessels at ranges of up to 20 km. Thanet Extension array boundary, at 73 km^2, represents a very small percentage of the potential habitat available to seals associated with each site screened in. In any case, the habitat within Thanet Extension array will not be lost to seals and therefore the natural range of the species and availability of habitat will not be reduced and will be maintained.

11.3.87 There is, therefore, no AEoI to the harbour seal and grey seal features of the transboundary sites in relation to increased vessel traffic from Thanet Extension alone and therefore, subject to natural change, the harbour porpoise, harbour seal and grey seal features of these sites will be maintained in the long-term.

Cable installation, seabed preparation and drilling for foundation installation

11.3.88 Other, non-piling underwater noise sources include cable installation techniques (such as ploughing, trenching, rock dumping and jetting), dredging of the seabed prior to cable or foundation installation and drilling for foundation installation. Information on the sound produced by the specific vessels and construction activities for this project are not available, however, parallels can be drawn from similar projects and vessels. Previously, Subacoustech have provided estimated noise levels for cable laying, rock placing and trenching as 171 - 172 dB re 1µPa @ 1m (RMS) which is considerably lower than that produced by pile driving (244 - 247 dB re 1µPa @ 1m SPLpeak), therefore, during the period of piling operations it is therefore considered unlikely that these activities will impact marine mammal receptors at anything other than immediate proximity. Individuals have more potential to be impacted by these activities during periods when piling is not taking place.

11.3.89 In another example, Xodus Group Ltd (2015) conducted noise modelling for a cable laying vessel, similar to the type which will be used for the construction of this project. This modelling concluded that the radius of potential injury from cable laying vessels was 25 m for Low Frequency (LF) cetaceans, 15 m for Mid Frequency (MF) cetaceans, 12 m for High Frequency (HF) cetaceans and 50 m for pinnipeds – assuming continuous exposure within that radius over a 24 hour period. These values mean that animals would have to stay within these very small ranges for 24 hours before they experienced injury, which is an extremely unlikely scenario as it is far more likely that any marine mammal within the injury zone would move away from the vicinity of the vessel.

11.3.90 The potential effects of cabling techniques used in the offshore wind farm industry was reviewed in a report by BERR in association with DEFRA (BERR and DEFRA 2008). The report reviewed various cable types and installation methods including burial ploughs, machines, ROVs and sleds and the burial methods themselves including jetting, rock ripping, and dredging. The review concluded that it would be “highly unlikely that cable installation would produce noise at a level that would cause a behavioural reaction in marine mammals”.

11.3.91 Subacoustech estimated noise levels for dredging as 186 dB re 1µPa @ 1m (RMS). However, most of the noise emitted is broadband with frequencies below 1 kHz, it is unlikely to cause any auditory injury, and is more likely to cause masking and behavioural impacts for lower frequency cetacean species (Todd *et al*. 2015) which are not of concern at Thanet Extension.

11.3.92 The behavioural impacts of non-piling underwater construction noise have been previously assessed for a number of other projects. Results have been previously expressed based on the dBht level (species weighted, which takes account of the frequency range of hearing of a species), where 90 dBht is a "strong avoidance in virtually all individuals" and 75 dBht is a "mild behavioural reaction" (Nedwell *et al*. 2007). The estimated behavioural impact ranges were higher for harbour porpoise compared to harbour seals, and extended furthest for trenching and rock dumping activities with "mild behavioural reactions" predicted out to 640 m from trenching. While these impact ranges are indicative, due to the generic nature of the activities assessed, effects are likely to be small scale and temporary, therefore disturbance as a result of non-piling construction noise is assessed as being low magnitude and low sensitivity for all marine mammal species, resulting in an overall minor significance which is not significant in EIA terms.

11.3.93 Given the nature of underwater noise associated with such non-piling construction activity when compared to that during piling operations, together with the known reaction of marine mammals to such non-piling related construction noise, it is reasonable to conclude that the potential for an AEoI in relation to the SNS cSAC/SCI and the transboundary sites for harbour porpoise, harbour seal and grey seal is less than that concluded during piling. There is, therefore, no AEoI to the harbour porpoise, harbour seal and grey seal features in relation to non-piling related construction noise from Thanet Extension alone and therefore, subject to natural change, the harbour porpoise, harbour seal and grey seal features of these sites will be maintained in the long-term.

Geophysical survey

11.3.94 Geophysical survey, by definition, results in the emission of underwater noise. The pre-construction geophysical survey for Thanet Extension is planned to occur prior to the UXO clearance and the piling, however dates (or the relevant season) have not yet been confirmed. At the earliest, the survey could occur in 2019 (with 2020 being more likely). At its closest point, the array boundary is located some 229 km from the summer extents of the SNS cSAC/SCI and at least 23 km from all transboundary sites screened in; all these transboundary sites and the summer seasonal component of the SNS cSAC/SCI lie beyond the 5 - 10 km harbour porpoise EDR range for geophysical survey. The assessment is therefore limited to the winter extents of the SNS cSAC/SCI, partly due to the EDR but also, primarily for harbour and grey seals, given the much reduced spatial and temporal effect resulting from geophysical surveys compared to construction piling and how that relates to the much larger extent of available habitat (with construction piling resulting in no AEoI for the project alone for all sites).

11.3.95 The potential for the geophysical survey to affect the viability of harbour porpoise in relation to the SNS cSAC/SCI is a function of the type and nature of the survey. Should particularly high energy sources be required (such as air guns), relevant JNCC guidance[85] will be followed to mitigate potential significant effects. As regards potential for disturbance, as a worst-case scenario, if it assumed that the geophysical survey would cover the array, the potential for a spatial disturbance effect to occur within the SNS cSAC/SCI can be determined. Based on a 5 km buffer, the spatial effect would be up to 166 km^2 (1.31% of the winter component), and based on a 10 km buffer, up to 370 km^2 (2.92% of winter component) would be affected. These areas are significantly below both the 20% threshold for a single day and as they are below 10% in a day, the 10% threshold across a season could not be exceeded. The potential for such a survey to affect the third conservation objective remains as assessed for piling noise.

11.3.96 It is reasonable to conclude that the potential for an AEoI in relation to geophysical survey for the SNS cSAC/SCI and the transboundary sites for harbour porpoise, harbour seal and grey seal is less than that concluded during piling. There is, therefore, no AEoI to the harbour porpoise, harbour seal and grey seal features in relation to underwater noise associated with a project geophysical survey from Thanet Extension alone and therefore, subject to natural change, the harbour porpoise, harbour seal and grey seal features of these sites will be maintained in the long-term.

[85] http://jncc.defra.gov.uk/marine/seismic_survey

Table 11.4: Spatial Extent of Disturbance within the Designated Sites

Designated Site	Potential Effect from Geophysical Survey	
	Area of effect (km^2)	% of site/ winter seasonal component
Assumed 10 km buffer for survey		
SNS cSAC/SCI	Max: 370 km^2	Max: 2.92% (winter extents)
Bancs des Flandres SCI	Max: 0 km^2	Max: 0% (total SCI)
Assumed 10 km buffer for survey		
SNS cSAC/SCI	Max: 370 km^2	Max: 2.92% (winter extents)
Bancs des Flandres SCI	Max: 0 km^2	Max: 0% (total SCI)

370000 380000 390000 400000 410000 420000 430000 440000

5720000 5710000 5700000 5690000 5680000 5670000

N

RS

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

GoBe VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

Figure 11.6

Spatial Extent of Possible Geophysical Surveys (if required) with the SNS cSAC

Legend

- Offshore Red Line Boundary
- Onshore Red Line Boundary
- Cable Exclusion Area
- Southern North Sea cSAC
- 5 km Buffer Overlap with the SNS cSAC
- 10 km Buffer Overlap with the SNS cSAC

Datum: ETRS 1989
Projection: UTM31N

1:250,000 0 2.5 5 km 0 1.5 3 nm

Drg No	Fig11.6_GeophysSNScSAC			**Figure 11.6**
Rev	0.1	Date	01/02/2019	
By	RM	Layout	N/A	

Use of Acoustic Deterrent Devices as part of marine mammal mitigation

11.3.97 As noted above, part of the mitigation for the project includes a MMMPs (as separate MMMPs for both UXO clearance, if required, and piling). It is anticipated that provision might be made within the MMMPs for the use of ADDs. The intended effect of the use of the ADD (combined with the use of a soft start) would be to reduce the risk that marine mammals would be in proximity to the source of piling noise/ UXO clearance, to mitigate against the risk of mortality or PTS. The application of the ADD will be short-term and temporary (the duration would be specific to the requirements of piling or UXO clearance, to be agreed with SNCBs) prior to each event, with only one active deployment at any one time. The level of noise associated with the use of ADDs would be significantly less than that generated during piling or UXO clearance and certainly contained within the EDR of the greater activity.

11.3.98 Use of ADDs has led to a conclusion of no LSE in previous assessments for the SNS cSAC/SCI (e.g. Hornsea P2 and East Anglia ONE), that conclusion being a function of the type of noise, its scale and duration of potential effect. That conclusion is considered to apply equally here, if not more so given the location of Thanet Extension in relation to the SNS cSAC/SCI (i.e. a significant proportion of ADD use would occur outside the SNS cSAC/SCI boundary).

Multiple Activities in a Single Winter Season

11.3.99 It is clear that for Thanet Extension alone, when individual project activities are considered independently, that there is no potential for an AEoI on either the SNS cSAC/SCI or the Bancs des Flandres SCI. However, given the short-term nature of the piling operations and anticipated level of UXO clearances, there is potential for all noisy activities to occur within a relatively short period of time – although no more than one such activity (i.e. piling OR UXO clearance OR geophysical survey) would occur within a single 24 hours and therefore the 20% threshold would not be exceeded.

11.3.100 Timing of such activities is relevant to the SNS cSAC/SCI, specifically with respect to the 10% threshold that is required to be met across a season. For Thanet Extension, this applies to the winter season only (given the distance to the summer seasonal extents). As the timing of the geophysical survey, the UXO clearance and the start date of piling operations will not be confirmed until closer to construction (although the geophysical survey and UXO clearance could occur as early as 2019 but is more likely to occur from 2020), a worst-case temporal assumption has been made here that all that activity could occur within a single winter season. The assumption is applied to enable a worst-case scenario to be assessed and the potential for Thanet Extension alone as a whole to affect the 10% seasonal threshold to be tested.

11.3.101 The assessment has applied the following assumptions:

- Piling to occur at 36 foundation locations within a six month winter season, assuming (as the worst-case) foundations to be installed individually (i.e. only one foundation per day), with a maximum spatial effect per day of 10.31% and duration of 36 days;
- Up to 30 UXO clearances on 30 separate days, each resulting in a maximum spatial area of effect of 10.31%; and
- Geophysical survey, with an assumed 10 km buffer and therefore maximum spatial extent of effect of 2.92%, lasting 10 days.

11.3.102 Should all the above activity occur at Thanet Extension within the same 6 month period (wholly within a single winter season), the combined affect when averaged across that season would be 3.90%, and therefore would remain well below the 10% seasonal threshold and therefore there would be no potential for an AEoI to the SNS cSAC/SCI. It is also apparent that capacity exists for additional UXO clearances, or a longer geophysical survey period, if required and appropriately managed (particularly taking account of any in-combination issues), without exceeding the threshold.

Operations and Maintenance

Accidental Pollution (operation and maintenance)

11.3.103 The potential for an AEoI as a result of accidental pollution on marine mammals during operation and maintenance relates to the following designated sites and the relevant feature (i.e. those features screened in for LSE).

- Southern North Sea cSAC/SCI (harbour porpoise); and
- Bancs des Flandres SCI (harbour porpoise, harbour seal and grey seal).

11.3.104 The potential for accidental pollution to affect marine mammals was not considered in the ES (Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7), given the inclusion of the following in the project specific mitigation able (Table 7.15) :

'A Project Environmental Management Plan (PEMP) will be produced and followed to cover the construction and O&M phases. This will also incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. MMO, Maritime and Coastguard Agency (MCA) and the project site co-ordinator). A decommissioning programme will be developed to cover the decommissioning phase. The purpose of the measures to be implemented ensure that potential for contaminant release is strictly controlled and therefore provides protection to marine life across all phases of the life of the project.'

11.3.105 The implementation of the PEMP, produced in consultation with Natural England and provided for in the DCO as part of the standard dML requirements, enables the conclusion that there is, therefore, no AEoI to the marine mammals in relation to accidental pollution from Thanet Extension alone and therefore, subject to natural change, the marine mammal features will be maintained in the long term with respect to the potential for accidental pollution.

Marine Mammal Conclusion

11.3.106 The above assessment considers AEoI of the SNS cSAC/SCI and transboundary sites for harbour porpoise, harbour seal and grey seal from Thanet Extension alone during construction and decommissioning. The assessment draws on the consideration of LSE alone made in the Screening Matrix (Annex 2, Application Ref 5.2.2), which concluded that the potential for LSE relates to underwater noise during construction and accidental pollution at all stages of the project.

11.3.107 The inclusion of project mitigation enables a conclusion of no AEoI as regards accidental pollution. For underwater noise, each of the Conservation Objectives for harbour porpoise (applying those available in the UK to the French site, given the lack of conservation objectives for the transboundary site), and for seals the requirements for FCS, have been considered in turn, to enable an assessment of the potential to lead to an AEoI. In each case, the conclusion of no AEoI from Thanet Extension alone has been confidently drawn, with quantified evidence presented to demonstrate how the effects from underwater noise will not exceed thresholds under any construction scenario.

11.3.108 It can therefore be concluded that, with the mitigation in place (as per section 6), Thanet Extension alone will not lead to an AEoI of the SNS cSAC/SCI or transboundary sites screened in for marine mammals during construction, operation and maintenance or decommissioning and therefore ensure that, subject to natural change, the sites will be maintained in the long-term.

11.4 Offshore Ornithology

11.4.1 A description of the significance of project level effects upon the receptors grouped under 'offshore ornithology' is provided below.

Construction and Decommissioning

Disturbance and Displacement

11.4.2 The potential for disturbance and displacement to result in an AEoI relates to the following designated sites and the relevant features:

- Outer Thames Estuary SPA; red-throated diver;
- Flamborough and Filey Coast SPA; guillemot, razorbill and the breeding seabird assemblage in so far as that includes guillemot and razorbill;
- Northumberland Marine SPA; guillemot and the breeding seabird assemblage in so far as that includes guillemot;
- Farne Islands SPA; guillemot and the breeding seabird assemblage in so far as that includes guillemot; and
- St Abb's Head to Fast Castle SPA; guillemot and razorbill and the breeding seabird assemblage in so far as that includes guillemot and razorbill.

11.4.3 The construction phase has the potential to affect birds in the marine environment through disturbance due to construction activities, including the installation of foundations, towers, blades, export cables and other infrastructure and the movement of vessels and helicopters. The disturbance created has the potential to result in displacement of birds from the site of construction, from an area around it and from routes used by vessels to access the construction site. This displacement would effectively result in temporary habitat loss through a reduction in the area available to birds for feeding, resting and moulting.

11.4.4 Any impacts resulting from disturbance and displacement from these activities are considered to be short-term, temporary and reversible in nature, lasting only for the duration of construction activity, as birds would return to the area once construction activities have ceased. Disturbance and displacement of birds during the construction phase is most likely to affect birds foraging in and around the construction area. The level of disturbance at each work location would differ dependent on the activities taking place, but there could be vessel movements at any time of day or night over the entire construction period.

11.4.5 Some species are more susceptible than others to disturbance from construction activities which may lead to subsequent displacement. Species such as divers have been noted to avoid shipping with one study identifying red-throated diver flushing at a median value of 400 m and a maximum value of 2 km (Bellebaum *et al*., 2006).

11.4.6 There are a number of different measures used to assess bird disturbance and displacement from areas of sea in response to activities associated with an offshore wind farm. Garthe and Hüppop (2004) developed a scoring system for such disturbance factors, which is used widely in OWF EIAs. Furness and Wade (2012) developed disturbance ratings for particular species, alongside scores for habitat flexibility and conservation importance in Scottish waters. These factors were used to define an index value that highlights the sensitivity of a species to disturbance and displacement. As many of these references relate to disturbance from helicopter and vessel activities, these are considered relevant to this assessment. Bradbury *et al*. (2014) provided an update to the Furness and Wade (2012) paper to consider seabirds in English waters. More recently a joint SNCB interim displacement advice note (SNCBs, 2017) provides the latest advice for UK development applications on how to consider, assess and present information and potential consequences of seabird displacement from OWFs.

Outer Thames Estuary SPA - red-throated diver

11.4.7 Red-throated diver has been identified as being particularly sensitive to human activities in marine areas, including through the disturbance effects of ship and helicopter traffic (Garthe and Hüppop, 2004, Schwemmer *et al*., 2011, Furness and Wade, 2012, Wade *et al*., 2016; SNCBs, 2017).

11.4.8 During the construction period red-throated divers may be subject to potential disturbance and displacement from Thanet Extension and potentially around it as well as the OECC, due to activities associated with the installation of WTGs and vessel movements in and out of the site. However, construction activities will be limited spatially, as construction works will not simultaneously occur at all WTG locations. The evidence from the TOWF during-construction monitoring surveys is that displacement of red-throated divers within the site was 82% and beyond the site boundary there was no displacement (Royal HaskoningDHV, 2013). Consequently, any potential effects are predicted to be limited to within a sphere of influence within Thanet Extension (with the site based evidence rounded up on a precautionary basis to the next 5% category value as 85% predicted displacement for the purposes of the application of a numeric value in the displacement matrices) and not extend into the 4 km distance around it.

11.4.9 The peak seasonal density recorded (from which peak seasonal abundance can be derived) was during the winter period when red-throated divers were present in Thanet Extension with a mean peak density of 2.66 birds/ km^2 or an abundance of 194 individuals. If an 85% displacement rate is applied to the winter red-throated diver population within Thanet Extension then an estimated 165 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of red-throated divers potentially subject to mortality is between zero and eight individuals. The displacement matrix for a population of 194 red-throated divers is presented in Table 11.5.

Table 11.5: Displacement matrix presenting the number of red-throated divers in the Thanet Extension site only, during the winter bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	1	1	1	1	1	2	2	2
10	0	0	1	2	4	6	8	10	12	14	16	17	19
20	0	0	2	4	8	12	16	19	23	27	31	35	39
30	0	1	3	6	12	17	23	29	35	41	47	52	58
40	0	1	4	8	16	23	31	39	47	54	62	70	78
50	0	1	5	10	19	29	39	49	58	68	78	87	97
60	0	1	6	12	23	35	47	58	70	81	93	105	116
70	0	1	7	14	27	41	54	68	81	95	109	122	136
80	0	2	8	16	31	47	62	78	93	109	124	140	155
85	0	2	8	16	33	49	66	82	99	115	132	148	165
90	0	2	9	17	35	52	70	87	105	122	140	157	175
100	0	2	10	19	39	58	78	97	116	136	155	175	194

11.4.10 The peak seasonal density recorded in the spring migration period when red-throated divers were present in the Thanet Extension site with a mean peak density of 0.60 birds/ km^2 or an abundance of 44 individuals. If an 85% displacement rate is applied to the spring migration red-throated diver population within the Thanet Extension site then an estimated 37 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of red-throated divers potentially subject to mortality is between zero and two individuals. The displacement matrix for a population of 44 red-throated divers is presented in Table 11.6.

Table 11.6: Displacement matrix presenting the number of red-throated divers in the Thanet Extension site only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	1	2	2	3	3	4	4	4
20	0	0	0	1	2	3	4	4	5	6	7	8	9
30	0	0	1	1	3	4	5	7	8	9	11	12	13
40	0	0	1	2	4	5	7	9	11	12	14	16	18
50	0	0	1	2	4	7	9	11	13	15	18	20	22
60	0	0	1	3	5	8	11	13	16	18	21	24	26
70	0	0	2	3	6	9	12	15	18	22	25	28	31
80	0	0	2	4	7	11	14	18	21	25	28	32	35
85	0	0	2	4	7	11	15	19	22	26	30	34	37
90	0	0	2	4	8	12	16	20	24	28	32	36	40
100	0	0	2	4	9	13	18	22	26	31	35	40	44

11.4.11 When the two seasons are combined when red-throated diver are present (winter and spring migration) the collective total is 202 individuals.

11.4.12 None of the red-throated diver that were recorded within Thanet Extension can be directly attributed to the Outer Thames Estuary SPA population as none were recorded within that SPA (the areas of Thanet Extension and the SPA being mutually exclusive). It can be expected though that red-throated diver are mobile across the general area and that birds that occur at any one time outside the SPA might occur within it at another time. The population estimate for the wider Thames Estuary area from which the Outer Thames Estuary SPA was derived was 8,132 birds (O'Brien *et al*., 2012). From the same population distribution data the boundary of the Outer Thames Estuary SPA was defined and identified as including 6,466 individuals. From these two population figures it can be determined that 79.5% of the total population can be attributed to the Outer Thames Estuary SPA at any one time. This value can also be used to attribute the proportion of the birds using Thanet Extension that might, given regular mixing of the population between areas within and outside the SPA, be associated with the SPA. The combined peak seasonal abundance recorded was 202 individuals, from which 161 could be attributed to the SPA on this basis. Even if all these birds were subject to mortality as a result of disturbance and displacement this would represent 2.5% of the population of the Outer Thames Estuary SPA. As described above, displacement resultant mortality is predicted to be in the range of 1 - 5% with a resultant mortality prediction between two and eight individuals. Eight individuals represent 0.1% of the Outer Thames Estuary SPA population. Background annual survival of red-throated diver has been estimated as 0.84 (Robinson, 2017). On this basis 1,035 individuals out of the population of the Outer Thames Estuary SPA might be expected to die each year. The eight individuals identified above as being the prediction for displacement resultant mortality from the construction of Thanet Extension is a 0.7% increase in background mortality. This very small, temporary increase in mortality makes no material difference to the long-term maintenance of the red-throated diver population of the Outer Thames Estuary SPA.

11.4.13 As part of the consideration of the potential for AEoI, account has also to be taken of the fact that construction works are temporary and localised in nature.

11.4.14 There is, therefore, no potential for AEoI to the red-throated diver feature of the Outer Thames Estuary SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Flamborough and Filey Coast SPA - Guillemot

11.4.15 Guillemots are considered to have Low to Medium general sensitivity to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004), Furness and Wade (2012), Wade *et al*. (2016) and the SNCB guidance (SNCBs, 2017).

11.4.16 During the construction period guillemots may be subject to potential disturbance and displacement from Thanet Extension and potentially around it as well as the OECC, due to activities associated with the installation of WTGs and vessel movements in and out of the site. However, construction activities will be limited spatially, as construction works will not simultaneously occur at all WTG locations. The evidence from the TOWF during-construction monitoring surveys is that displacement of guillemots within the site was 67% and beyond the site boundary up to 25% displacement within a 1 km distance around it occurred (Royal HaskoningDHV, 2013). This local site based evidence is applied and any potential effects are predicted to be limited to within a sphere of influence within Thanet Extension and a 1 km distance around it only. This local site based evidence has been rounded up on a precautionary basis to the 5% category value of 70% for within the site and 25% within a 1 km distance around it (this rounding is for the purposes of the application of a numeric value in the displacement matrices).

11.4.17 Guillemot numbers peaked in the spring migration period in Thanet Extension with a mean peak density of 8.26 birds/km^2 and a mean peak abundance estimate of 602 individuals. Within the 4 km survey buffer around Thanet Extension numbers also peaked in the spring migration period with a mean peak density of 5.39 birds/km^2 and a mean peak abundance estimate of 1,142 individuals.

11.4.18 If a 70% displacement rate is applied to the spring migration mean peak estimate of 602 within Thanet Extension then an estimated 421 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of guillemots potentially subject to mortality is between four and 21 individuals. The displacement matrix for a population of 602 guillemots is presented in **Table** 11.7.

Table **11.7: Displacement matrix presenting the number of guillemots in the Thanet Extension site only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)**

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	1	1	2	2	3	4	4	5	5	6
10	0	1	3	6	12	18	24	30	36	42	48	54	60
20	0	1	6	12	24	36	48	60	72	84	96	108	120
30	0	2	9	18	36	54	72	90	108	126	144	163	181
40	0	2	12	24	48	72	96	120	144	169	193	217	241
50	0	3	15	30	60	90	120	151	181	211	241	271	301
60	0	4	18	36	72	108	144	181	217	253	289	325	361
70	0	4	21	42	84	126	169	211	253	295	337	379	421
80	0	5	24	48	96	144	193	241	289	337	385	433	482
90	0	5	27	54	108	163	217	271	325	379	433	488	542
100	0	6	30	60	120	181	241	301	361	421	482	542	602

11.4.19 If a 25% displacement rate is applied to the spring migration peak estimate of 235 within the 1 km distance around Thanet Extension then an estimated 59 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of guillemots potentially subject to mortality is between one and three individuals. The displacement matrix for a population of 253 guillemots is presented in Table 11.8.

Table **11.8: Displacement matrix presenting the number of guillemots in the 1 km Buffer only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)**

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	1	1	1	1	2	2	2	2
10	0	0	1	2	5	7	9	12	14	16	19	21	23
20	0	0	2	5	9	14	19	23	28	33	38	42	47
25	0	1	3	6	12	18	23	29	35	41	47	53	59
30	0	1	4	7	14	21	28	35	42	49	56	63	70
40	0	1	5	9	19	28	38	47	56	66	75	84	94
50	0	1	6	12	23	35	47	59	70	82	94	106	117
60	0	1	7	14	28	42	56	70	84	99	113	127	141
70	0	2	8	16	33	49	66	82	99	115	131	148	164
80	0	2	9	19	38	56	75	94	113	131	150	169	188
90	0	2	11	21	42	63	84	106	127	148	169	190	211
100	0	2	12	23	47	70	94	117	141	164	188	211	235

11.4.20 The mean peak numbers in the breeding season, autumn migration and winter periods were considerably lower and these can be added to the peak seasonal numbers for the spring migration period described above to produce an annual total. Collectively, the total number of potentially displaced guillemots on an annual basis (in this case all four seasons) would be 986 individuals within the Thanet Extension site and 449 in a 1 km buffer surrounding Thanet Extension. If 70% and 25% displacement rates are applied to these annual totals created by summing across the seasons to the Thanet Extension site and the 1 km buffer respectively then an estimated 690 and 112 individuals, or 802 in total, may be subject to potential displacement. The estimated number of guillemots potentially subject to mortality per annum would therefore be between eight and 40 individuals (this is based upon mortality rates of 1% or 5%).

11.4.21 None of the guillemot that was recorded within and around Thanet Extension can be directly attributed to the Flamborough and Filey Coast SPA. It can be expected that outside the breeding season guillemot from the Flamborough and Filey Coast SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Flamborough and Filey Coast SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 114,003 birds to the total (calculated on the basis of an SPA population 41,607 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 114,003). From these two population figures it can be determined that 7.5% of the total population in the UK waters of the North Sea can be attributed to the Flamborough and Filey Coast SPA at any one time.

11.4.22 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction on an annual basis (recognising that this is precautionary as that any total includes breeding season birds which clearly cannot be attributed to the SPA) of between eight and 40 individuals. Forty individuals represent 0.035% of the Flamborough and Filey Coast SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 6,156 individuals out of the population of the Flamborough and Filey Coast SPA. The 40 individuals identified above as being the prediction for displacement 5% resultant mortality from the construction of Thanet Extension is a 0.65% increase in background mortality of the Flamborough and Filey Coast SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the Flamborough and Filey Coast SPA.

11.4.23 As part of the consideration of the potential for AEoI, account has also to be taken of the fact that construction works are temporary and localised in nature.

11.4.24 There is, therefore, no potential for AEoI to the guillemot feature of the Flamborough and Filey Coast SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Flamborough and Filey Coast SPA - Razorbill

11.4.25 Razorbills are considered to have Medium general sensitivity to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004), Furness and Wade (2012), Wade *et al.* (2016) and the SNCB guidance (SNCBs, 2017).

11.4.26 During the construction period razorbills may be subject to potential disturbance and displacement from Thanet Extension and possibly around it as well as the OECC, due to activities associated with the installation of WTGs and vessel movements in and out of the site. However, construction activities will be limited spatially, as construction works will not simultaneously occur at all WTG locations. The evidence from the TOWF during-construction monitoring surveys is that displacement of razorbills within the site was 89% and beyond the site boundary, possibly up to 25% (but not significant) displacement within a 1 km distance around it occurred (Royal HaskoningDHV, 2013). Consequently, any potential effects are predicted to be limited to within a sphere of influence within Thanet Extension and a 1 km distance around it only. This local site based evidence has been rounded up on a precautionary basis to the 5% category value of 90% for within the site and 25% within a 1 km distance around it (this rounding is for the purposes of the application of a numeric value in the displacement matrices).

11.4.27 Razorbills were recorded within Thanet Extension predominantly during the migration-spring and winter periods with mean peak estimates of 29 and 28 individuals, respectively (or densities of 0.40 and 0.38 birds/ km^2). Razorbills were also recorded within the 4 km buffer, mostly during the migration-spring period, but also the migration autumn and winter periods, with mean peak estimates of 215, 52 and 71 individuals, respectively (or densities of 1.02, 0.25 and 0.33 birds/ km^2).

11.4.28 If a 90% displacement rate is applied to the spring migration mean peak estimate of 29 within Thanet Extension then an estimated 26 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of razorbills potentially subject to mortality is between zero and one individual. The displacement matrix for a population of 29 razorbills is presented in Table 11.9.

Table 11.9: Displacement matrix presenting the number of razorbills in the Thanet Extension site only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	1	1	1	2	2	2	3	3
20	0	0	0	1	1	2	2	3	3	4	5	5	6
30	0	0	0	1	2	3	3	4	5	6	7	8	9
40	0	0	1	1	2	3	5	6	7	8	9	10	12
50	0	0	1	1	3	4	6	7	9	10	12	13	15
60	0	0	1	2	3	5	7	9	10	12	14	16	17
70	0	0	1	2	4	6	8	10	12	14	16	18	20
80	0	0	1	2	5	7	9	12	14	16	19	21	23
90	0	0	1	3	5	8	10	13	16	18	21	23	26
100	0	0	1	3	6	9	12	15	17	20	23	26	29

11.4.29 If a 25% displacement rate is applied to the spring migration peak estimate of 44 within the 1 km distance around Thanet Extension then an estimated 11 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of razorbills potentially subject to mortality is between zero and one individual. The displacement matrix for a population of 44 razorbills is presented below:

Table 11.10: Displacement matrix presenting the number of razorbills in the 1 km Buffer only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	1	2	2	3	3	4	4	4
20	0	0	0	1	2	3	4	4	5	6	7	8	9
25	0	0	1	1	2	3	4	6	7	8	9	10	11
30	0	0	1	1	3	4	5	7	8	9	11	12	13
40	0	0	1	2	4	5	7	9	11	12	14	16	18
50	0	0	1	2	4	7	9	11	13	16	18	20	22
60	0	0	1	3	5	8	11	13	16	19	21	24	27
70	0	0	2	3	6	9	12	16	19	22	25	28	31
80	0	0	2	4	7	11	14	18	21	25	28	32	36
90	0	0	2	4	8	12	16	20	24	28	32	36	40
100	0	0	2	4	9	13	18	22	27	31	36	40	44

11.4.30 The displacement resultant mortality estimates for Thanet Extension and a 1 km distance around it can be summed to give a project alone 1% and 5% resultant mortality estimate of zero and two respectively.

11.4.31 The mean peak numbers in the autumn migration and winter periods were lower (with none in the breeding season) and these can be added to the peak seasonal numbers for the spring migration period described above to produce an annual total. Collectively, the total number of potentially displaced razorbills within all periods (in this case the migration-spring, migration-autumn and wintering periods only) and across both the Thanet Extension site and a 1 km buffer would be 73 individuals. The estimated number of razorbills potentially subject to mortality per annum would therefore be between one and two individuals (this is based upon mortality rates of 1% or 5%).

11.4.32 None of the razorbill that was recorded within and around Thanet Extension can be directly attributed to the Flamborough and Filey Coast SPA. It can be expected that outside the breeding season razorbill from the Flamborough and Filey Coast SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for razorbill (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 591,874 (Furness, 2015), of which 157,443 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Flamborough and Filey Coast SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 26,068 birds to the total (calculated on the basis of an SPA population 10,570 pairs x 2 plus 0.75 immatures per adult [from Furness, 2015] = 26,068). From these two population figures it can be determined that 18.5% of the total population in the UK waters of the North Sea can be attributed to the Flamborough and Filey Coast SPA at any one time.

11.4.33 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction on an annual basis of between zero and two individuals. Two individuals represent 0.008% of the Flamborough and Filey Coast SPA total population (adults plus immatures). Background annual survival of razorbill has been estimated as 0.900 (Robinson, 2017). On this basis 15,744 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 2,097 individuals out of the population of the Flamborough and Filey Coast SPA. The two individuals identified above as being the prediction for displacement 5% resultant mortality from the construction of Thanet Extension is a 0.10% increase in background mortality of the Flamborough and Filey Coast SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the razorbill population of the Flamborough and Filey Coast SPA.

11.4.34 As part of the consideration of the potential for AEoI, account has also to be taken of the fact that construction works are temporary and localised in nature.

11.4.35 There is, therefore, no potential for AEoI to the razorbill feature of the Flamborough and Filey Coast SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, razorbill will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.36 The components of the breeding seabird assemblage that were screened in for assessment were guillemot and razorbill. The detailed quantitative assessment of these two species above has identified no potential for AEoI.

11.4.37 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the Flamborough and Filey Coast SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Northumberland Marine SPA - Guillemot

11.4.38 The nature of the construction activities; the sensitivity of guillemot to human activities; the guillemot density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km distance around it at 1% and 5% resultant mortality are eight and 40 respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.39 None of the guillemot that was recorded within and around Thanet Extension can be directly attributed to the Northumberland Marine SPA. It can be expected that outside the breeding season guillemot from the Northumberland Marine SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Northumberland Marine SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 90,080 birds to the total (calculated on the basis of an SPA population 32,876 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 90,080). From these two population figures it can be determined that 5.9% of the total population in the UK waters of the North Sea can be attributed to the Northumberland Marine SPA at any one time.

11.4.40 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction on an annual basis between eight and 40 individuals. Forty individuals represent 0.044% of the Northumberland Marine SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 4,864 individuals out of the population of the Northumberland Marine SPA. The 40 individuals identified above as being the prediction for displacement 5% resultant mortality from the construction of Thanet Extension is a 0.82% increase in background mortality of the Northumberland Marine SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the Northumberland Marine SPA.

11.4.41 As part of the consideration of the potential for AEoI, account has also to be taken of the fact that construction works are temporary and localised in nature.

11.4.42 There is, therefore, no potential for AEoI to the guillemot feature of the Northumberland Marine SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.43 The component of the breeding seabird assemblage that was screened in for assessment was guillemot. The detailed quantitative assessment for this species above has identified no potential for AEoI.

11.4.44 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the Northumberland Marine SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Farne Islands SPA - Guillemot

11.4.45 The nature of the construction activities; the sensitivity of guillemot to human activities; the guillemot density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km buffer around it at 1% and 5% resultant mortality are eight and 40 respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.46 None of the guillemot that was recorded within and around Thanet extension can be directly attributed to the Farne Islands SPA. It can be expected that outside the breeding season guillemot from the Farne Islands SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Farne Islands SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 90,078 birds to the total (calculated on the basis of an SPA population 32,875 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 90,078). From these two population figures it can be determined that 5.9% of the total population in the UK waters of the North Sea can be attributed to the Farne Islands SPA at any one time.

11.4.47 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction on an annual basis of between eight and 40 individuals. Forty individuals represent 0.044% of the Farne Islands SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 4,864 individuals out of the population of the Farne Islands SPA. The 40 individuals identified above as being the prediction for displacement 5% resultant mortality from the construction of Thanet Extension is a 0.82% increase in background mortality of the Farne Islands SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the Farne Islands SPA.

11.4.48 As part of the consideration of the potential for AEoI, account has also to be taken of the fact that construction works are temporary and localised in nature.

11.4.49 There is, therefore, no potential for AEoI to the guillemot feature of the Farne Islands SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.50 The component of the breeding seabird assemblage that was screened in for assessment was guillemot. The detailed quantitative assessment for this species above has identified no potential for AEoI.

11.4.51 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the Farne Islands SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

St Abb's Head to Fast Castle SPA - Guillemot

11.4.52 The nature of the construction activities; the sensitivity of guillemot to human activities; the guillemot density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km distance around it at 1% and 5% resultant mortality are eight and 40 respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.53 None of the guillemot that was recorded within and around Thanet Extension can be directly attributed to the St Abb's Head to Fast Castle SPA. It can be expected that outside the breeding season guillemot from the St Abb's Head to Fast Castle SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the St Abb's Head to Fast Castle SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 85,762 birds to the total (calculated on the basis of an SPA population 31,300 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 85,762). From these two population figures it can be determined that 5.6% of the total population in the UK waters of the North Sea can be attributed to the St Abb's Head to Fast Castle SPA at any one time.

11.4.54 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction on an annual basis of between eight and 40 individuals. Forty individuals represent 0.046% of the St Abb's Head to Fast Castle SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 4,631 individuals out of the population of the St Abb's Head to Fast Castle SPA. The 40 individuals identified above as being the prediction for displacement resultant mortality from the construction of Thanet Extension is a 0.86% increase in background mortality of the St Abb's Head to Fast Castle SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the St Abb's Head to Fast Castle SPA.

11.4.55 As part of the consideration of the potential for AEoI, account has also to be taken of the fact that construction works are temporary and localised in nature.

11.4.56 There is, therefore, no potential for AEoI to the guillemot feature of the St Abb's Head to Fast Castle SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

St Abb's Head to Fast Castle SPA - Razorbill

11.4.57 The nature of the construction activities; the sensitivity of razorbill to human activities; the razorbill density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km distance around it at 1% and 5% resultant mortality are zero and two respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.58 None of the razorbill that was recorded within and around Thanet Extension can be directly attributed to the St Abb's Head to Fast Castle SPA. It can be expected that outside the breeding season razorbill from the St Abb's Head to Fast Castle SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for razorbill (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 591,874 (Furness, 2015), of which 157,443 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the St Abb's Head to Fast Castle SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 5,995 birds to the total (calculated on the basis of an SPA population 2,180 pairs x 2 plus 0.75 immatures per adult [from Furness, 2015] = 5,995). From these two population figures it can be determined that 3.8% of the total population in the UK waters of the North Sea can be attributed to the St Abb's Head to Fast Castle SPA at any one time.

11.4.59 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction on an annual basis of between zero and two individuals. Two individuals represent 0.033% of the St Abb's Head to Fast Castle SPA total population (adults plus immatures). Background annual survival of razorbill has been estimated as 0.900 (Robinson, 2017). On this basis 15,744 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 600 individuals out of the population of the St Abb's Head to Fast Castle SPA. The two individuals identified above as being the prediction for displacement 5% resultant mortality from the construction of Thanet Extension is a 0.33% increase in background mortality of the St Abb's Head to Fast Castle SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the razorbill population of the St Abb's Head to Fast Castle SPA.

11.4.60 As part of the consideration of the potential for AEoI, account has also to be taken of the fact that construction works are temporary and localised in nature.

11.4.61 There is, therefore, no potential for AEoI to the razorbill feature of the St Abb's Head to Fast Castle SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, razorbill will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.62 The components of the breeding seabird assemblage that were screened in for assessment were guillemot and razorbill. The detailed quantitative assessment of these two species above has identified no potential for AEoI.

11.4.63 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the St Abb's Head to Fast Castle SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Operations and Maintenance

Disturbance and Displacement

11.4.64 The potential for disturbance and displacement to result in an AEoI relates to the following designated sites and the relevant features:

- Outer Thames Estuary SPA; red-throated diver;
- Flamborough and Filey Coast SPA; guillemot and razorbill;
- Northumberland Marine SPA; guillemot;
- Farne Islands SPA; guillemot;
- St Abb's Head to Fast Castle SPA; guillemot and razorbill.

11.4.65 The O&M phase has the potential to affect birds in the marine environment through disturbance due to the physical presence of the WTGs and the activities that occur to maintain those WTGs with related vessel and helicopter movements. The disturbance created has the potential to result in displacement of birds from the site of WTG operation, from a distance around it and from routes used by vessels to access the operational site. This displacement would effectively result in habitat loss through a reduction in the area available to birds for feeding, resting and moulting. Information on studies that have examined the extent of displacement has already been given in the introductory section on disturbance and displacement during the construction phase.

Outer Thames Estuary SPA - Red-throated Diver

11.4.66 Red-throated diver has been identified as being particularly sensitive to human activities in marine areas, including through the disturbance effects of ship and helicopter traffic (Garthe and Hüppop, 2004, Schwemmer *et al*., 2011, Furness and Wade, 2012, Wade *et al*., 2016; SNCBs, 2017).

11.4.67 During the operational phase red-throated divers may be subject to potential disturbance and displacement from Thanet Extension due to activities associated with the maintenance of WTGs (vessel movements in and out of the site) as well as the presence of the operating WTGs. The evidence from the TOWF post-construction (i.e. operation) monitoring surveys is that displacement of red-throated divers within the site was 73% (Royal HaskoningDHV, 2013). The monitoring of other constructed OWFs in and around the Outer Thames Estuary has identified that the degree of displacement from within a wind farm is very high (as it has also been shown to be on the European side of the North Sea). Accordingly, a more precautionary 100% displacement is applied within the footprint of Thanet Extension in the operational phase. Beyond the TOWF site boundary there was no displacement identified (Royal HaskoningDHV, 2013). Accounting for this locally derived site based evidence, any potential displacement effects are predicted to be limited to within a sphere of influence within Thanet Extension and not to extend into an area around.

11.4.68 The peak seasonal density recorded (from which peak seasonal abundance can be derived) was during the winter period when red-throated divers were present in Thanet Extension with a mean density of 2.66 birds/ km^2 or an abundance of 194 individuals. If a 100% displacement rate is applied to the winter red-throated diver population within Thanet Extension then an estimated 194 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of red-throated divers potentially subject to mortality is between two and 10 individuals. The displacement matrix for a population of 194 red-throated divers is presented in Table 11.11.

Table 11.11: Displacement matrix presenting the number of red-throated divers in the Thanet Extension site only, during the winter bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	1	1	1	1	1	2	2	2
10	0	0	1	2	4	6	8	10	12	14	16	17	19
20	0	0	2	4	8	12	16	19	23	27	31	35	39
30	0	1	3	6	12	17	23	29	35	41	47	52	58
40	0	1	4	8	16	23	31	39	47	54	62	70	78
50	0	1	5	10	19	29	39	49	58	68	78	87	97
60	0	1	6	12	23	35	47	58	70	81	93	105	116
70	0	1	7	14	27	41	54	68	81	95	109	122	136
80	0	2	8	16	31	47	62	78	93	109	124	140	155
90	0	2	9	17	35	52	70	87	105	122	140	157	175
100	0	2	10	19	39	58	78	97	116	136	155	175	194

11.4.69 The peak seasonal density recorded is the spring migration period when red-throated divers were present in the Thanet Extension site with a mean peak density of 0.60 birds/ km^2 or an abundance of 44 individuals. If a 100% displacement rate is applied to the spring migration red-throated diver population within the Thanet Extension site then an estimated 44 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of red-throated divers potentially subject to mortality is between zero and two individuals. The displacement matrix for a population of 44 red-throated divers is presented in Table 11.12.

11.4.70 When the two seasons are combined when red-throated diver are present (winter and spring migration) the collective total is 238 individuals.

Table 11.12: Displacement matrix presenting the number of red-throated divers in the Thanet Extension site only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	1	2	2	3	3	4	4	4
20	0	0	0	1	2	3	4	4	5	6	7	8	9
30	0	0	1	1	3	4	5	7	8	9	11	12	13
40	0	0	1	2	4	5	7	9	11	12	14	16	18
50	0	0	1	2	4	7	9	11	13	15	18	20	22
60	0	0	1	3	5	8	11	13	16	18	21	24	26
70	0	0	2	3	6	9	12	15	18	22	25	28	31
80	0	0	2	4	7	11	14	18	21	25	28	32	35
90	0	0	2	4	8	12	16	20	24	28	32	36	40
100	0	0	2	4	9	13	18	22	26	31	35	40	44

11.4.71 None of these red-throated diver that were recorded within Thanet Extension can be directly attributed to the Outer Thames Estuary SPA population as none were recorded within that SPA (the areas of Thanet Extension and the SPA being mutually exclusive). It can be expected though that red-throated diver are mobile across the general area and that birds that occur at any one time outside the SPA might occur within it at another time. The population estimate for the wider Thames Estuary area from which the Outer Thames Estuary SPA was derived was 8,132 birds (O'Brien *et al*., 2012). From the same population distribution data the boundary of the Outer Thames Estuary SPA was defined and identified as including 6,466 individuals. From these two population figures it can be determined that 79.5% of the total population can be attributed to the Outer Thames Estuary SPA at any one time. This value can also be used to attribute the proportion of the birds using Thanet Extension that might, given regular mixing of the population between areas within and outside the SPA, be associated with the SPA. The combined peak seasonal abundance recorded was 238 individuals, from which 189 could be attributed to the SPA on this basis. Even if all these birds were subject to mortality as a result of disturbance and displacement this would represent 2.9% of the population of the Outer Thames Estuary SPA. As described above, displacement resultant mortality is predicted to be in the range of 1 - 5% with a resultant mortality prediction for the 189 birds attributed to the SPA of between two and nine individuals. Nine individuals represent 0.15% of the Outer Thames Estuary SPA population. Background annual survival of red-throated diver has been estimated as 0.84 (Robinson, 2017). On this basis 1,035 individuals out of the population of the Outer Thames Estuary SPA might be expected to die each year. The nine individuals identified above as being the prediction for displacement resultant mortality from the O&M of Thanet Extension is a 0.87% increase in background mortality. This very small increase in mortality makes no material difference to the long-term maintenance of the red-throated diver population of the Outer Thames Estuary SPA.

11.4.72 There is, therefore, no potential for AEoI to the red-throated diver feature of the Outer Thames Estuary SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Flamborough and Filey Coast SPA - Guillemot

11.4.73 Guillemots are considered to have Low to Medium general sensitivity to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004), Furness and Wade (2012), Wade *et al.* (2016) and the SNCB guidance (SNCBs, 2017).

11.4.74 During the O&M phase guillemots may be subject to potential disturbance and displacement from Thanet Extension and potentially around it due to the presence of the WTGs and activities associated with the maintenance of the WTGs (vessel movements in and out of the site). The evidence from the TOWF post-construction monitoring surveys is that displacement of guillemots within the site was 79% and beyond the site boundary up to 23% displacement within a 1 km distance around it occurred (Royal HaskoningDHV, 2013). This local site based evidence is applied and any potential effects are predicted to be limited to within a sphere of influence within Thanet Extension and a 1 km distance around it only. This local site based evidence has been rounded up on a precautionary basis to the 5% category value of 80% for within the site and 25% within a 1 km distance around it (this rounding is for the purposes of the application of a numeric value in the displacement matrices).

11.4.75 Guillemot numbers peaked in the spring migration period in Thanet Extension with a mean peak density of 8.26 birds/km^2 and a mean peak abundance estimate of 602 individuals. Within the 4 km survey distance around Thanet Extension numbers also peaked in the spring migration period with a mean peak density of 5.39 birds/km^2 and an abundance estimate of 1,142 individuals.

11.4.76 If an 80% displacement rate is applied to the spring migration mean peak estimate of 602 within Thanet Extension then an estimated 482 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of guillemots potentially subject to mortality is between five and 24 individuals. The displacement matrix for a population of 602 guillemots is presented in Table 11.13.

Table 11.13: Displacement matrix presenting the number of guillemots in the Thanet Extension site only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	1	1	2	2	3	4	4	5	5	6
10	0	1	3	6	12	18	24	30	36	42	48	54	60
20	0	1	6	12	24	36	48	60	72	84	96	108	120
30	0	2	9	18	36	54	72	90	108	126	144	163	181
40	0	2	12	24	48	72	96	120	144	169	193	217	241
50	0	3	15	30	60	90	120	151	181	211	241	271	301
60	0	4	18	36	72	108	144	181	217	253	289	325	361
70	0	4	21	42	84	126	169	211	253	295	337	379	421
80	0	5	24	48	96	144	193	241	289	337	385	433	482
90	0	5	27	54	108	163	217	271	325	379	433	488	542
100	0	6	30	60	120	181	241	301	361	421	482	542	602

11.4.77 If a 25% displacement rate is applied to the spring migration peak estimate of 235 within the 1 km distance around Thanet Extension then an estimated 80 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of guillemots potentially subject to mortality is between one and four individuals. The displacement matrix for a population of 235 guillemots is presented in Table 11.14.

Table 11.14: Displacement matrix presenting the number of guillemots in the 1 km Buffer only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	1	1	1	1	2	2	2	2
10	0	0	1	2	5	7	9	12	14	16	19	21	23
20	0	0	2	5	9	14	19	23	28	33	38	42	47
25	0	1	3	6	12	18	23	29	35	41	47	53	59
30	0	1	4	7	14	21	28	35	42	49	56	63	70
40	0	1	5	9	19	28	38	47	56	66	75	84	94
50	0	1	6	12	23	35	47	59	70	82	94	106	117
60	0	1	7	14	28	42	56	70	84	99	113	127	141
70	0	2	8	16	33	49	66	82	99	115	131	148	164
80	0	2	9	19	38	56	75	94	113	131	150	169	188
90	0	2	11	21	42	63	84	106	127	148	169	190	211
100	0	2	12	23	47	70	94	117	141	164	188	211	235

11.4.78 The mean peak numbers in the breeding season, autumn migration and winter periods were considerably lower and these can be added to the peak seasonal numbers for the spring migration period described above to produce an annual total. Collectively, the total number of potentially displaced guillemots on an annual basis (in this case all four seasons) would be 986 individuals within the Thanet Extension site and 449 in a 1 km buffer surrounding Thanet Extension. If 80% and 25% displacement rates are applied to these annual totals created by summing across the seasons to the Thanet Extension site and the 1 km buffer respectively, then an estimated 789 and 112 individuals, or 901 in total, may be subject to potential displacement. The estimated number of guillemots potentially subject to mortality per annum would therefore be between nine and 45 individuals (this is based upon mortality rates of 1% or 5%).

11.4.79 None of the guillemots that were recorded within and around Thanet extension can be directly attributed to the Flamborough and Filey Coast SPA. It can be expected that outside the breeding season guillemot from the Flamborough and Filey Coast SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Flamborough and Filey Coast SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 114,003 birds to the total (calculated on the basis of an SPA population 41,607 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 114,003). From these two population figures it can be determined that 7.5% of the total population in the UK waters of the North Sea can be attributed to the Flamborough and Filey Coast SPA at any one time.

11.4.80 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction on an annual basis (recognising that this is precautionary as that any total includes breeding season birds which clearly cannot be attributed to the SPA) of between nine and 45 individuals. Forty five individuals represent 0.039% of the Flamborough and Filey Coast SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 6,156 individuals out of the population of the Flamborough and Filey Coast SPA. The 45 individuals identified above as being the prediction for displacement 5% resultant mortality from the O&M of Thanet Extension is a 0.73% increase in background mortality of the Flamborough and Filey Coast SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the Flamborough and Filey Coast SPA.

11.4.81 There is, therefore, no potential for AEoI to the guillemot feature of the Flamborough and Filey Coast SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Flamborough and Filey Coast SPA - Razorbill

11.4.82 Razorbills are considered to have Medium general sensitivity to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004), Furness and Wade (2012), Wade *et al*. (2016) and the SNCB guidance (SNCBs, 2017).

11.4.83 During the O&M phase razorbills may be subject to potential disturbance and displacement from Thanet Extension and potentially around it due to the presence of the WTGs and activities associated with the maintenance of the WTGs (vessel movements in and out of the site). The evidence from the TOWF post-construction monitoring surveys is that displacement of razorbills within the site was 95% and beyond the site boundary up to possibly 25% (but not significant) displacement within a 1 km distance around it occurred (Royal HaskoningDHV, 2013). This local site based evidence is applied and any potential effects are predicted to be limited to within a sphere of influence within Thanet Extension and a 1 km distance around it only. This local site based evidence has been rounded up on a precautionary basis to the 5% category value of 95% for within the site and 25% within a 1 km distance around it (this rounding is for the purposes of the application of a numeric value in the displacement matrices).

11.4.84 Razorbills were recorded within the Thanet Extension site predominantly during the migration-spring and winter periods with mean peak estimates of 29 and 28 individuals, respectively (or densities of 0.40 and 0.38 birds/ km^2). Razorbills were also recorded within the 4 km buffer, mostly during the migration-spring period, but also the migration autumn and winter periods, with mean peak estimates of 215, 52 and 71 individuals, respectively (or densities of 1.02, 0.25 and 0.33 birds/ km^2).

11.4.85 If a 95% displacement rate is applied to the spring migration mean peak estimate of 29 within Thanet Extension then an estimated 28 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of razorbills potentially subject to mortality is between zero and one individual. The displacement matrix for a population of 61 razorbills is presented below:

Table 11.15: Displacement matrix presenting the number of razorbills in the Thanet Extension site only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	1	1	1	2	2	2	3	3
20	0	0	0	1	1	2	2	3	3	4	5	5	6
30	0	0	0	1	2	3	3	4	5	6	7	8	9
40	0	0	1	1	2	3	5	6	7	8	9	10	12
50	0	0	1	1	3	4	6	7	9	10	12	13	15
60	0	0	1	2	3	5	7	9	10	12	14	16	17
70	0	0	1	2	4	6	8	10	12	14	16	18	20
80	0	0	1	2	5	7	9	12	14	16	19	21	23
90	0	0	1	3	5	8	10	13	16	18	21	23	26
95	0	0	1	3	6	8	11	14	17	19	22	25	28
100	0	0	1	3	6	9	12	15	17	20	23	26	29

11.4.86 If a 25% displacement rate is applied to the spring migration peak estimate of 44 within the 1 km distance around Thanet Extension then an estimated 11 individuals may be subject to potential displacement. If this number of displaced birds were subject to mortality rates of 1% or 5% then the estimated number of razorbills potentially subject to mortality is between zero and one individual. The displacement matrix for a population of 44 razorbills is presented in Table 11.16.

Table 11.16: Displacement matrix presenting the number of razorbills in the 1 km Buffer only, during the spring migration bio-season that may be subject to displacement (highlighted in green) or mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)												
	0	1	5	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	1	1	2	2	3	3	4	4	4
20	0	0	0	1	2	3	4	4	5	6	7	8	9
25	0	0	1	1	2	3	4	6	7	8	9	10	11
30	0	0	1	1	3	4	5	7	8	9	11	12	13
40	0	0	1	2	4	5	7	9	11	12	14	16	18
50	0	0	1	2	4	7	9	11	13	16	18	20	22
60	0	0	1	3	5	8	11	13	16	19	21	24	27
70	0	0	2	3	6	9	12	16	19	22	25	28	31
80	0	0	2	4	7	11	14	18	21	25	28	32	36
90	0	0	2	4	8	12	16	20	24	28	32	36	40
95	0	0	2	4	8	13	17	21	25	30	34	38	42
100	0	0	2	4	9	13	18	22	27	31	36	40	44

11.4.87 The mean peak numbers in the autumn migration and winter periods were lower (with none in the breeding season) and these can be added to the peak seasonal numbers for the spring migration period described above to produce an annual total. Collectively, the total number of potentially displaced razorbills within all periods (in this case the migration-spring, migration-autumn and wintering periods only) and across both the Thanet Extension site and a 1 km buffer would be 73 individuals. The estimated number of razorbills potentially subject to mortality per annum would therefore be between one and two individuals (this is based upon mortality rates of 1% or 5%).

11.4.88 None of the razorbill that was recorded within and around Thanet Extension can be directly attributed to the Flamborough and Filey Coast SPA. It can be expected that outside the breeding season razorbill from the Flamborough and Filey Coast SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for razorbill (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 591,874 (Furness, 2015), of which 157,443 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Flamborough and Filey Coast SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 26,068 birds to the total (calculated on the basis of an SPA population 10,570 pairs x 2 plus 0.75 immatures per adult [from Furness, 2015] = 26,068). From these two population figures it can be determined that 18.5% of the total population in the UK waters of the North Sea can be attributed to the Flamborough and Filey Coast SPA at any one time.

11.4.89 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction between one and two individuals. Two individuals represent 0.008% of the Flamborough and Filey Coast SPA total population (adults plus immatures). Background annual survival of razorbill has been estimated as 0.900 (Robinson, 2017). On this basis 15,744 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 2,907 individuals out of the population of the Flamborough and Filey Coast SPA. The two individuals identified above as being the prediction for displacement 5% resultant mortality from the O&M of Thanet Extension is a 0.07% increase in background mortality of the Flamborough and Filey Coast SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the razorbill population of the Flamborough and Filey Coast SPA.

11.4.90 There is, therefore, no potential for AEoI to the razorbill feature of the Flamborough and Filey Coast SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, razorbill will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.91 The components of the breeding seabird assemblage that were screened in for assessment were guillemot and razorbill. The detailed quantitative assessment of these two species above has identified no potential for AEoI.

11.4.92 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the Flamborough and Filey Coast SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Northumberland Marine SPA - Guillemot

11.4.93 The nature of the O&M activities; the sensitivity of guillemot to human activities; the guillemot density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km distance around it at 1% and 5% resultant mortality are nine and 45 respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.94 None of the guillemot that was recorded within and around Thanet extension can be directly attributed to the Northumberland Marine SPA. It can be expected that outside the breeding season guillemot from the Northumberland Marine SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Northumberland Marine SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 90,080 birds to the total (calculated on the basis of an SPA population 32,876 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 90,080). From these two population figures it can be determined that 5.9% of the total population in the UK waters of the North Sea can be attributed to the Northumberland Marine SPA at any one time.

11.4.95 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction between nine and 45 individuals. Forty five individuals represent 0.050% of the Northumberland Marine SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 4,864 individuals out of the population of the Northumberland Marine SPA. The 45 individuals identified above as being the prediction for displacement 5% resultant mortality from the O&M of Thanet Extension is a 0.92% increase in background mortality of the Northumberland Marine SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the Northumberland Marine SPA.

11.4.96 There is, therefore, no potential for AEoI to the guillemot feature of the Northumberland Marine SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.97 The component of the breeding seabird assemblage that was screened in for assessment was guillemot. The detailed quantitative assessment for this species above has identified no potential for AEoI.

11.4.98 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the Northumberland Marine SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Farne Islands SPA - Guillemot

11.4.99 The nature of the O&M activities; the sensitivity of guillemot to human activities; the guillemot density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km distance around it at 1% and 5% resultant mortality are nine and 45 respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.100 None of the guillemot that was recorded within and around Thanet Extension can be directly attributed to the Farne Islands SPA. It can be expected that outside the breeding season guillemot from the Farne Islands SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the Farne Islands SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 90,078 birds to the total (calculated on the basis of an SPA population 32,875 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 90,078). From these two population figures it can be determined that 5.9% of the total population in the UK waters of the North Sea can be attributed to the Farne Islands SPA at any one time.

11.4.101 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction between nine and 45 individuals. Forty five individuals represent 0.050% of the Farne Islands SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 4,864 individuals out of the population of the Farne Islands SPA. The 45 individuals identified above as being the prediction for displacement 5% resultant mortality from the O&M of Thanet Extension is a 0.92% increase in background mortality of the Farne Islands SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the Farne Islands SPA.

11.4.102 There is, therefore, no potential for AEoI to the guillemot feature of the Farne Islands SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.103 The component of the breeding seabird assemblage that was screened in for assessment was guillemot. The detailed quantitative assessment for this species above has identified no potential for AEoI.

11.4.104 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the Farne Islands SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

St Abb's Head to Fast Castle SPA - Guillemot

11.4.105 The nature of the O&M activities; the sensitivity of guillemot to human activities; the guillemot density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km distance around it at 1% and 5% resultant mortality are nine and 45 respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.106 None of the guillemot that was recorded within and around Thanet Extension can be directly attributed to the St Abb's Head to Fast Castle SPA. It can be expected that outside the breeding season guillemot from the St Abb's Head to Fast Castle SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for guillemot (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 1,617,306 (Furness, 2015), of which 1,523,146 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the St Abb's Head to Fast Castle SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 85,762 birds to the total (calculated on the basis of an SPA population 31,300 pairs x 2 plus 0.74 immatures per adult [from Furness, 2015] = 85,762). From these two population figures it can be determined that 5.6% of the total population in the UK waters of the North Sea can be attributed to the St Abb's Head to Fast Castle SPA at any one time.

11.4.107 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction between nine and 45 individuals. Forty five individuals represent 0.052% of the St Abb's Head to Fast Castle SPA total population (adults plus immatures). Background annual survival of guillemot has been estimated as 0.946 (Robinson, 2017). On this basis 82,250 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 4,631 individuals out of the population of the St Abb's Head to Fast Castle SPA. The 45 individuals identified above as being the prediction for displacement resultant mortality from the O&M of Thanet Extension is a 0.97% increase in background mortality of the St Abb's Head to Fast Castle SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the guillemot population of the St Abb's Head to Fast Castle SPA.

11.4.108 There is, therefore, no potential for AEoI to the guillemot feature of the St Abb's Head to Fast Castle SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, guillemot will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

St Abb's Head to Fast Castle SPA - Razorbill

11.4.109 The nature of the O&M activities; the sensitivity of razorbill to human activities; the razorbill density and abundance in and around Thanet Extension; the predictions for the number displaced; and the predictions for the resultant mortality (identified in a matrix) have already been set out under the text for the Flamborough and Filey Coast SPA and apply equally to this SPA. The displacement resultant mortality estimates on an annual basis for Thanet Extension and a 1 km distance around it at 1% and 5% resultant mortality are one and two individuals respectively. What differs is the proportion that these estimates represent of this particular SPA population.

11.4.110 None of the razorbill that was recorded within and around Thanet Extension can be directly attributed to the St Abb's Head to Fast Castle SPA. It can be expected that outside the breeding season razorbill from the St Abb's Head to Fast Castle SPA will disperse widely away from the breeding site, mixing with birds originating from other breeding colonies. The population estimate for razorbill (adults plus immatures) in the UK waters of the North Sea outside of the breeding season is 591,874 (Furness, 2015), of which 157,443 are considered to be UK birds. If it is assumed, this being the precautionary assumption, that all birds from the St Abb's Head to Fast Castle SPA remain in the UK waters of the North Sea outside the breeding season, then they will contribute 5,995 birds to the total (calculated on the basis of an SPA population 2,180 pairs x 2 plus 0.75 immatures per adult [from Furness, 2015] = 5,995). From these two population figures it can be determined that 3.8% of the total population in the UK waters of the North Sea can be attributed to the St Abb's Head to Fast Castle SPA at any one time.

11.4.111 Displacement resultant mortality is predicted to be in the range of 1% to 5% with a resultant mortality prediction between one and two individuals. Two individuals represent 0.033% of the St Abb's Head to Fast Castle SPA total population (adults plus immatures). Background annual survival of razorbill has been estimated as 0.900 (Robinson, 2017). On this basis 15,744 individuals out of the population of the UK waters of the North Sea might be expected to die each year and 600 individuals out of the population of the St Abb's Head to Fast Castle SPA. The two individuals identified above as being the prediction for displacement 5% resultant mortality from the O&M of Thanet Extension is a 0.33% increase in background mortality of the St Abb's Head to Fast Castle SPA population. This very small increase in mortality makes no material difference to the long-term maintenance of the razorbill population of the St Abb's Head to Fast Castle SPA.

11.4.112 There is, therefore, no potential for AEoI to the razorbill feature of the St Abb's Head to Fast Castle SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, razorbill will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Breeding seabird assemblage

11.4.113 The components of the breeding seabird assemblage that were screened in for assessment were guillemot and razorbill. The detailed quantitative assessment of these two species above has identified no potential for AEoI.

11.4.114 There is, therefore, no potential for AEoI to the breeding seabird assemblage feature of the St Abb's Head to Fast Castle SPA in relation to disturbance and displacement effects from Thanet Extension alone and therefore, subject to natural change, the breeding seabird assemblage will be maintained as a feature in the long-term with respect to the potential for adverse effects from disturbance and displacement.

Collision Risk

11.4.115 The potential for mortality resultant from collision risk to result in an AEoI relates to the following designated sites and the relevant features:

- Outer Thames Estuary SPA; common tern and little tern;
- Flamborough and Filey Coast SPA; gannet and kittiwake;
- Foulness (Mid-Essex Coast Phase 5) SPA; Sandwich tern;
- Alde-Ore Estuary SPA; lesser black-backed gull;
- Alde-Ore Estuary Ramsar; lesser black-backed gull; and
- St Abb's Head to Fast Castle SPA; kittiwake.

11.4.116 There is a potential collision risk to birds which fly through the proposed development site whilst foraging for food, commuting between breeding sites and foraging areas, or when on migration. The risk to birds arises from colliding with the WTG rotors and associated infrastructure resulting in injury or fatality.

11.4.117 CRM has been used to estimate the potential risk to birds associated with the proposed development. The approach to CRM is presented in Volume 4, Annex 4-4 to the ES and provides the methods, data input and results of the CRM. Modelling has been carried out using the Band (2012) model applied in Microsoft Excel to the density of flying birds measured by 24 months of aerial survey to produce predictions of mortality for particular species across set time periods (biological seasons) and on an annual basis. This most recent version of the Band model has been designed specifically for application to OWF developments.

11.4.118 CRM accounts for a number of different species-specific behavioural aspects of birds being assessed, including the height at which birds fly, their ability to avoid moving or static structures and how active they are diurnally and nocturnally, respectively. Details of these considerations are provided in in Volume 4, Annex 4-4.

11.4.119 The collision predictions included in this assessment present the results that have been output from a specific set of model runs. This is Band CRM Option 2 incorporating the bird flight height information drawn from the BTO SOSS-02 report (Cook et al, 2012) that sets out the percentage at potential collision height (PCH) for each seabird species determined from a large number of surveys carried out in UK waters. The avoidance rates applicable to Band CRM Option 2 (Cook et al, 2014) have been used, updated where relevant to account for the SNCB review of those avoidance rates ((JNCC et al, 2014). The outputs from the application of alternative model options, PCH determined from other survey data sets and a range of values around the mean values for some factors the annual collision estimates are presented from the maximum likelihood mean density outputs with corresponding lower and upper confidence interval values are included in Volume 4, Annex 4-4 to the ES.

11.4.120 It should be recognised that the collision estimates provided by the modelling are expected to be an overestimate of annual mortality rates, that is they are a precautionary assessment. This is the result of a number of factors, including:

- Modelling using the worst-case turbine array with respect to collision risk (a development of 34 10 MW WTGs);
- Assuming a continuous flux of birds through the Thanet Extension site at a rate resulting from the mean peak density for the relevant bio-season being applied on all days in that bio-season;
- Assuming that flying birds encounter all WTGs within the Thanet Extension site and the level of activity remains constant regardless of losses; and
- Assuming each bird crosses through the longest possible trajectory in a straight line through the Thanet Extension site.

11.4.121 It is recognised that in the parameters used as inputs to the collision risk modelling there is both potential variation around the true value where numbers arise from sample surveys and there are also differences in opinion between the Applicant and stakeholders as to which of certain values within a range should be used as model inputs. To account for this a report was submitted to the Examination at Deadline 1 in the form of a Written Representation/ Clarification Note on collision risk modelling parameters (Annex F to Appendix 1 of the Applicant's Deadline 1 Submission (PINS Ref REP1-023)). Set out below are assessments based on the values of parameters that are submitted by the Applicant as representing a reasonable approach to accounting for precaution in those instances where there is an element of uncertainty or disagreement in particular values. Reference should be made to the Written Representation/ Clarification Note (Appendix 1 of the Applicant's Deadline 2 Submission) for the range of predictions that result when different input values are used.

Outer Thames Estuary SPA - Common tern

11.4.122 Common tern was added as an interest feature to the Outer Thames Estuary SPA in autumn 2017. As a result it was not included in the screening for LSE presented in the HRA Screening Report (Annex 1 to this report) and it was not considered in the collision risk modelling presented in the PEIR. Common tern was screened in on a precautionary basis for collision risk pending a more detailed consideration of the potential for LSE.

11.4.123 The Outer Thames Estuary SPA has common tern as an interest feature in order to provide protection for the population while foraging in coastal and marine waters in association with its nesting colony SPAs on the Suffolk and Essex coasts. The nearest of those colonies is at New England Creek within the Foulness SPA that is 46 km distant from the array. This is beyond the mean maximum foraging range of 15.2 km +/- 11.2 km (Thaxter et al., 2012) and as a result the potential for collision risk in the breeding season has been screened out (section 7). Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey recorded 'commic' tern (that on a precautionary basis can all be ascribed to common tern) on two occasions (counts of 2 in April 2016 and 17 in May 2017) in the 4 km buffer and not at all in Thanet Extension or TOWF. Terns on passage to a breeding colony on the Suffolk or Essex coast would only pass the region of Thanet Extension once in spring and once in autumn and as a result the risks of collision are extremely low. Cook et al (2012) determined that 12.7% of common tern flights would be at PCH. Quantitative CRM is not justified for this species.

11.4.124 Given the very low numbers recorded, the very low number of potential passes across the region of Thanet Extension and the low flight height, the risk of collision is extremely low as is the potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.125 There is, therefore, no potential for AEoI to the common tern feature of the Outer Thames Estuary SPA in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, common tern will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

Little tern

11.4.126 Little tern was added as an interest feature to the Outer Thames Estuary SPA in autumn 2017. As a result it was not included in the screening for LSE presented in the HRA Screening Report (Annex 1 to this report) and it was not considered in the collision risk modelling presented in the PEI report. Little tern was screened in on a precautionary basis for collision risk pending a more detailed consideration of the potential for LSE.

11.4.127 The Outer Thames Estuary SPA has little tern as an interest feature in order to provide protection for the population while foraging in coastal waters in association with its nesting colony SPAs on the Suffolk and Essex coasts. The mean maximum foraging range is very short at 6.3 km +/- 2.4 km (Thaxter et al., 2012) and as a result the potential for collision risk in the breeding season has been screened out (section 7). Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey did not record little tern. Terns on passage to a breeding colony on the Suffolk or Essex coast would only pass the region of Thanet Extension once in spring and once in autumn and as a result the risks of collision are extremely low. Cook et al (2012) did not have sufficient data to analyse little tern flights, indicating how scarce is this species away from the coastal margin. Quantitative CRM is not justified for this species.

11.4.128 Given that none were recorded and the very low number of potential passes across the region of Thanet Extension, the risk of collision is extremely low as is the potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.129 There is, therefore, no potential for AEoI to the little tern feature of the Outer Thames Estuary SPA in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, little tern will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

Foulness (Mid-Essex Coast Phase 5) SPA - Sandwich tern

11.4.130 Sandwich tern was screened in on a precautionary basis for collision risk (Annex 1 to this report) pending a more detailed consideration of the potential for LSE based, on amongst other factors, the completion of the programme of 24 months of aerial survey.

11.4.131 The Sandwich tern breeding colony in the Foulness (Mid-Essex Coast Phase 5) SPA is within mean maximum foraging range of 49 km +/- 7.1 km (Thaxter et al., 2012) of Thanet Extension, raising the potential of collision risk in the breeding season. Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey recorded Sandwich tern on three occasions, in all instances single birds in the 4 km buffer, in the months of March 2016, April 2016 and April 2017. Terns on passage to a breeding colony on the Essex coast would only pass the region of Thanet Extension once in spring and once in autumn and as a result the risks of collision are extremely low. Cook et al (2012) determined that 3.6% of Sandwich tern flights would be at PCH. Quantitative CRM is not justified for this species.

11.4.132 Given the very low numbers recorded, the very low number of potential passes across the region of Thanet Extension and the low flight height, the risk of collision is extremely low as is the potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.133 There is, therefore, no potential for AEoI to the Sandwich tern feature of the Foulness (Mid-Essex Coast Phase 5) SPA in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, Sandwich tern will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

Alde-Ore Estuary SPA - lesser black-backed gull

11.4.134 Lesser black-backed gull was screened in on a precautionary basis for collision risk (Annex 1 to this report) pending a more detailed consideration of the potential for LSE based, on amongst other factors, the completion of the programme of 24 months of aerial survey.

11.4.135 The lesser black-backed gull breeding population in the Alde-Ore Estuary SPA is within mean maximum foraging range of 141 km +/-50.8 km (Thaxter et al., 2012) of Thanet Extension, raising the potential of collision risk in the breeding season. Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey recorded lesser black-backed gulls in the Thanet Extension site in all four seasons, with the highest density of 0.58 birds/ km^2 recorded during the spring period. The majority of the lesser black-backed gulls from the aerial digital survey abundance estimates (75%) within the Thanet Extension site were sitting on the water and not in flight.

11.4.136 The CRM predicted an annual total of 2.35 lesser black-backed gull collisions, consisting of 1.52 in the breeding season, 0.44 in the spring, none in the autumn and 0.40 in the winter. The precautionary approach to assessing the significance of this predicted number of collisions in relation to the Alde-Ore Estuary SPA is to assume that all the collisions in the breeding season occur to adult birds that are part of the Alde-Ore Estuary SPA breeding population (outside of the breeding season the site population will mix with the North Sea population and/or migrate to waters further south meaning that in effect none of the predicted collisions can be attributed to the site). The SPA breeding population at classification was 14,070 pairs (28,140 breeding adults). An annual collision prediction of 1.52 birds is 0.005% of the SPA population. With a baseline mortality rate of 12.6%, the background mortality of the SPA breeding population is 3,546 birds. The predicted collisions are a 0.043% increase relative to the background levels, this is a negligible change. There is no potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.137 There is, therefore, no potential for AEoI to the lesser black-backed gull feature of the Alde-Ore Estuary SPA in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, lesser black-backed gull will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

Alde-Ore Estuary Ramsar - lesser black-backed gull;

11.4.138 Lesser black-backed gull was screened in on a precautionary basis for collision risk (Annex 1 to this report) pending a more detailed consideration of the potential for LSE based, on amongst other factors, the completion of the programme of 24 months of aerial survey.

11.4.139 The lesser black-backed breeding population in the Alde-Ore Estuary Ramsar site is within mean maximum foraging range of 141 km +/-50.8 km (Thaxter et al., 2012) of Thanet Extension, raising the potential of collision risk in the breeding season. Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey recorded lesser black-backed gulls in the Thanet Extension site in all four seasons, with the highest density of 0.58 birds/ km^2 recorded during the spring period. The majority of the lesser black-backed gulls from the aerial digital survey abundance estimates (75%) within the Thanet Extension site were sitting on the water and not in flight.

11.4.140 The CRM predicted an annual total of 2.35 lesser black-backed gull collisions, consisting of 1.52 in the breeding season, 0.44 in the spring, none in the autumn and 0.40 in the winter. The precautionary approach to assessing the significance of this predicted number of collisions in relation to the Alde-Ore Estuary Ramsar site is to assume that all the collisions in the breeding season occur to adult birds that are part of the Alde-Ore Estuary Ramsar site breeding population (outside of the breeding season the site population will mix with the North Sea population and/or migrate to waters further south meaning that in effect none of the predicted collisions can be attributed to the site). The Ramsar site breeding population at lisitng was 5,790 pairs (11,580 breeding adults). An annual collision prediction of 1.52 birds is 0.013% of the Ramsar site population. With a baseline mortality rate of 12.6%, the background mortality of the Ramsar site breeding population is 1,459 birds. The predicted collisions are a 0.104% increase relative to the background level, this is a negligible change. There is no potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.141 There is, therefore, no potential for AEoI to the lesser black-backed gull feature of the Alde-Ore Estuary Ramsar site in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, lesser black-backed gull will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

Flamborough and Filey Coast SPA - Gannet

11.4.142 Gannet was screened in on a precautionary basis for collision risk (Annex 1 to this report) pending a more detailed consideration of the potential for LSE based, on amongst other factors, the completion of the programme of 24 months of aerial survey.

11.4.143 The gannet breeding colony in the Flamborough and Filey Coast SPA is outside of the mean maximum foraging range of 229.4 +/- 124.3 km (Thaxter et al., 2012) of Thanet Extension. Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey recorded gannets as being present in the Thanet Extension site in spring and autumn with the highest mean peak abundance of 77 birds with a density of 1.06 birds / km^2 estimated during the spring. The majority of gannets from the aerial digital survey abundance estimates (62%) were in flight in the Thanet Extension site and 4 km buffer.

11.4.144 The CRM predicted an annual total of 13.55 gannet collisions, consisting of 9.10 in the spring, none in the breeding season and 4.45 in the autumn (there is no winter bio-season for gannet). With no collisions predicted in the breeding season, the assessment has to consider what proportion of those birds present in the southern North Sea outside the breeding season may be attributed to the Flamborough and Filey Coast SPA population of 16,938 adult birds from amongst the larger population present. Furness (2015) provides the basis on which that apportioning can be made. Seventy percent of the SPA population is present in the North Sea in the spring migration period and all are present in the autumn migration period. This means that in the spring migration period 4.8% of the birds present can be attributed to the pSPA (70% of 16,938 divided by spring BDMPS of 248,385) and in the autumn period 3.7% of the birds present can be attributed to the pSPA (100% of 16,938 divided by the autumn BDMPS of 456,298). Accordingly, the collision predictions for the proposed Thanet Extension attributed to the SPA are 0.43 in spring and 0.17 in autumn. These predictions represent a 0.013% and 0.005% increase in mortality in spring and autumn respectively relative to the background levels, this is a negligible change. There is no potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.145 There is, therefore, no potential for AEoI to the gannet feature of the Flamborough and Filey Coast SPA in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, gannet will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

Flamborough and Filey Coast SPA - Kittiwake

11.4.146 Kittiwake was screened in on a precautionary basis for collision risk (Annex 1 to this report) pending a more detailed consideration of the potential for LSE based, on amongst other factors, the completion of the programme of 24 months of aerial survey.

11.4.147 Thanet Extension is outside of the mean maximum foraging range of 60 km +/- 23.3 km (Thaxter et al., 2012) of the kittiwake breeding colony in the Flamborough and Filey Coast SPA. Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey recorded kittiwakes in the Thanet Extension site during the spring, the breeding season and the autumn with the highest mean peak abundance being 235 birds and density of 3.23 birds / km^2 during the autumn. The majority of the kittiwakes from the aerial digital survey abundance estimates (63%) were sitting on the water in the Thanet Extension site.

11.4.148 The CRM predicted an annual total of 14.74 kittiwake collisions, consisting of 9.82 in the spring, 1.48 in the breeding season and 3.43 in the autumn (there is no winter bio-season for kittiwake). Those collisions predicted in the breeding season cannot be attributed to the SPA as Thanet Extension is beyond the mean maximum foraging range of kittiwake and the individuals observed in the survey can be expected to be a combination of immature birds, non-breeding adults and adults from a more local colony that is not part of the European site network. With respect to predicted collisions outside the breeding season the assessment has to consider what proportion of those birds present in the southern North Sea may be attributed to the Flamborough and Filey Coast SPA population of 89,040 adult birds from amongst the larger population present. Furness (2015) provides the basis on which that apportioning can be made. Sixty percent of the SPA population is present in the North Sea in both the spring and autumn migration periods. This means that in the spring migration period 8.5% of the birds present can be attributed to the SPA (60% of 89,040 divided by spring BDMPS of 627,816) and in the autumn period 6.4% of the birds present can be attributed to the SPA (60% of 89,040 divided by the autumn BDMPS of 829,937). Accordingly, the collision predictions for the proposed Thanet Extension attributed to the SPA are 0.84 in spring and 0.22 in autumn. These predictions represent a 0.006% and 0.002% increase in mortality in spring and autumn respectively relative to the background levels, this is a negligible change. There is no potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.149 There is, therefore, no potential for AEoI to the kittiwake feature of the Flamborough and Filey Coast SPA in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, kittiwake will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

St Abb's Head to Fast Castle SPA - Kittiwake

11.4.150 Kittiwake was screened in on a precautionary basis for collision risk (HRA Screening Report) pending a more detailed consideration of the potential for LSE based, on amongst other factors, the completion of the programme of 24 months of aerial survey.

11.4.151 The kittiwake breeding colony in the St Abb's Head to Fast Castle SPA is outside of the mean maximum foraging range of 60 km +/- 23.3 km (Thaxter et al., 2012) of Thanet Extension. Outside of the breeding season these birds may pass across the proposed site of Thanet Extension and be placed at risk of collision. The 24 months of aerial survey recorded kittiwakes in the Thanet Extension site during the spring, the breeding season and the autumn with the highest mean peak abundance being 235 birds and density of 3.23 birds / km^2 during the autumn. The majority of the kittiwakes from the aerial digital survey abundance estimates (63%) were sitting on the water in the Thanet Extension site.

11.4.152 The CRM predicted an annual total of 14.74 kittiwake collisions, consisting of 9.82 in the spring, 1.48 in the breeding season and 3.43 in the autumn (there is no winter bio-season for kittiwake). Those collisions predicted in the breeding season cannot be attributed to the SPA as Thanet Extension is beyond the mean maximum foraging range of kittiwake and the individuals observed in the survey can be expected to come from a more local colony that is not part of the European site network. With respect to predicted collisions outside the breeding season the assessment has to consider what proportion of those birds present in the southern North Sea may be attributed to the St Abb's Head to Fast Castle SPA population of 42,340 adult birds from amongst the larger population present. Furness (2015) provides the basis on which that apportioning can be made. Sixty percent of the SPA population is present in the North Sea in both the spring and autumn migration periods. This means that in the spring migration period 4.0% of the birds present can be attributed to the SPA (60% of 42,340 divided by spring BDMPS of 627,816) and in the autumn period 3.1% of the birds present can be attributed to the SPA (60% of 42,340 divided by the autumn BDMPS of 829,937). Accordingly, the collision predictions for the proposed Thanet Extension attributed to the SPA are 0.40 in spring and 0.10 in autumn. These predictions represent a 0.006% and 0.002% increase in mortality in spring and autumn respectively relative to the background levels, this is a negligible change. There is no potential for an adverse effect on the population and hence on the integrity of the SPA.

11.4.153 There is, therefore, no potential for AEoI to the kittiwake feature of the St Abb's Head to Fast Castle SPA in relation to collision risk effects from Thanet Extension alone and therefore, subject to natural change, kittiwake will be maintained as a feature in the long-term with respect to the potential for adverse effects from collision risk.

11.5 Onshore Biodiversity

11.5.1 Potential AEoI in respect of intertidal habitats for Thanet Coast and Sandwich Bay SPA qualifying features European golden plover and ruddy turnstone and Thanet Coast and the Sandwich Bay Ramsar qualifying features ruddy turnstone and the wetland invertebrate assemblage species *Orthotylus rubidus* were assessed within the subtidal and intertidal benthic ecology section.

11.5.2 As regards the potential for an AEoI from Thanet Extension alone on intertidal habitats and therefore on the designated bird and invertebrate features, the benthic ecology assessment concluded that:

- The impacts resulting from temporary habitat loss/ disturbance during construction, O&M and decommissioning within the intertidal habitats (which include saltmarsh and the mudflat foreshore), will be temporary and of short-term duration, extending across a very small proportion of the available habitat of both the SPA and Ramsar; therefore, the magnitude of the impact is assessed as low for the saltmarsh and mudflat foreshore and both sites will be maintained in the long-term. There is therefore no potential for AEoI to the bird qualifying features of the Thanet Coast and Sandwich Bay Ramsar (ruddy turnstone) and Thanet Coast and Sandwich Bay SPA (ruddy turnstone and European golden plover);
- Although the possible presence of this species cannot be conclusively ruled out, the bug *Orthotylus rubidus* (part of the wetland invertebrate assemblage qualifying feature for Thanet Coast and Sandwich Bay Ramsar) is not likely to be present within the area that would be affected by temporary habitat loss/ disturbance during construction, O&M and decommissioning. A detailed invertebrate survey of affected areas will be undertaken prior to construction commencing and if necessary specific mitigation measures will be developed through the LEMP to avoid and reduce impacts. There is therefore no potential for AEoI to the wetland invertebrate assemblage qualifying features of the Thanet Coast and Sandwich Bay Ramsar;
- There is no potential for AEoI to the intertidal habitats used by the designated features of the Thanet Coast and Sandwich Bay SPA (ruddy turnstone and European golden plover) and Thanet Coast and Sandwich Bay Ramsar (ruddy turnstone and the wetland invertebrate assemblage species *Orthotylus rubidus*, if present) in relation to increased suspended sediments and deposition effects during construction, O&M and decommissioning from Thanet Extension alone and therefore, subject to natural change, the intertidal habitats will be maintained in the long-term with respect to the potential for effect from increased suspended sediment and associated deposition;
- Measures to address accidental spills and avoid potential contaminant release during the construction and O&M phases will be detailed within a PEMP (a separate Decommissioning Programme will cover the decommissioning phase).. Following the implementation of the measures detailed in these plans there will be no potential for AEoI to the intertidal habitats used by the designated features of the Thanet Coast and Sandwich Bay SPA (ruddy turnstone and European golden plover) and Thanet Coast and Sandwich Bay Ramsar (ruddy turnstone and the wetland invertebrate assemblage species *Orthotylus rubidus*, if present) in relation to accidental pollution during construction, O&M and decommissioning; and

- Measures to prevent the spread of INNS during construction will be detailed within a PEMP (a separate Decommissioning Programme will cover the decommissioning phase), which will be developed and agreed with relevant stakeholders prior to construction commencing. Following the implementation of the measures detailed in these plans there will be no potential for AEoI to the intertidal habitats used by the designated features of the Thanet Coast and Sandwich Bay SPA (ruddy turnstone and European golden plover) and Thanet Coast and Sandwich Bay Ramsar (ruddy turnstone and the wetland invertebrate assemblage species *Orthotylus rubidus*, if present) in relation to the possible spread of INNS during construction and decommissioning.

11.5.3 Consideration of the potential for an AEoI for the remaining LSE in respect of onshore biodiversity receptors is provided below. This includes consideration of habitat loss for terrestrial species forming part of the Thanet Coast and Sandwich Bay Ramsar wetland invertebrate assemblage (construction, O&M and decommissioning) and possible effects on these species resulting from accidental pollution (construction, O&M and decommissioning) and the spread of INNS (construction and decommissioning). It also includes consideration of potential disturbance to Thanet Coast and Sandwich Bay SPA/ Ramsar qualifying bird species (European golden plover and ruddy turnstone and ruddy turnstone respectively) due to noise and visual disturbance (construction, O&M and decommissioning) and the possible displacement of recreational users from Pegwell Bay Country Park (construction and decommissioning).

Construction and Decommissioning

Habitat loss via land-take/ land cover change

11.5.4 The potential for habitat loss via land-take/ land cover change to result in an AEoI relates to the following designated sites and the relevant features:

- Thanet Coast and Sandwich Bay Ramsar:
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates

11.5.5 The habitat requirements of the three wetland invertebrate assemblage species with the potential to be present within or immediately adjacent to the RLB are as follows (see ES Volume 4, Annex 5-6: Terrestrial Invertebrate Assessment Report (Application Ref 6.5.5.6) for further details):

- *Didineis lunicornis* - strongly associated with patches of sun-baked bare or sparsely vegetated clay soil where deep desiccation cracks develop during summer months. Banks and level ground are both used. Many records relate to coastal soft rock cliffs, whilst inland records include unimproved grasslands (especially south-facing slopes), woodland rides and clearings, and re-vegetating quarries. Females prey on hoppers which are brought to nests typically dug close to waterbodies.
- *Ectemnius ruficornis* - associated with dead wood (fallen trees, stumps, old fence posts etc.) and dead parts of living trees, in sunny situations and in the vicinity of good stands of umbellifers. Seems to be more of a woodland insect in the southern parts of its British range but it likely has a preference for open woodland such as coppice. Its presence within the RLB is considered unlikely but can not be ruled out.
- *Eluma caelata* - A woodlouse that has a preference for disturbed habitats, whether this is on the coast (e.g. 'soft' slumping cliffs) or in synanthropic habitats (e.g. waste ground, railway lines and gardens). It typically takes refuge under mat-forming plants, beneath stones and dead wood, or among leaf-litter, tussocks, rubbish and other debris.

11.5.6 All three species are only likely to be present in the Stonelees Nature Reserve section of the RLB. Approximately 350 m of cabling would be trenched through Stonelees Nature Reserve, resulting in short-term loss of habitats including disturbed ground, scrub, semi-improved grassland and at least one small ephemeral water body over a width of up to 30 m. All habitat types are also present within the nature reserve in areas outside the RLB. Terrestrial habitats would be reinstated as soon as possible following completion of the works and ephemeral water bodies would be replaced.

11.5.7 Embedded mitigation includes the development of a TIMS (forming part of the detailed LEMP), which will be informed by a detailed invertebrate survey of affected areas and will be subject to agreement with the relevant planning authorities, in consultation with Natural England and other relevant stakeholders, prior to construction commencing (see the Outline LEMP (Document Ref.Application Ref 8.7) for further details. The precise selection of measures to be employed would depend on the results of the survey and the final design solution adopted, although at this stage it is considered likely that the measures relevant to the three assemblage species listed above, if present, would include:

- avoidance of suitable habitat by micro-siting, where possible;
- protection of retained habitats against inadvertent damage, e.g. by use of temporary fencing and ECoW supervision;
- reinstatement of suitable habitat as soon as possible following construction; and
- where possible, translocation of habitat features supporting the relevant species, e.g. dead wood (in the case of *Ectemnius ruficornis*) or other refugia, e.g. mat-forming plants, stones and dead wood, or leaf-litter, tussocks and other debris (in the case of *Eluma caelata*).

11.5.8 Suitable habitat for *Didineis lunicornis* tends to be transient in nature and the species will therefore be adapted to the temporary loss of small areas of habitat. Suitable habitat for this species is widespread within Stonelees Nature Reserve, including areas outside the RLB, and therefore following the proposed reinstatement of suitable habitat populations of this species, if present, are not likely to be affected. Suitable habitats for *Ectemnius ruficornis and Eluma caelata* are also widespread within Stonelees Nature Reserve and therefore following the proposed reinstatement of suitable habitat, plus the proposed translocation of suitable habitat features, populations of these species, if present, are also not likely to be affected.

11.5.9 There are no published conservation objectives for the Ramsar site. However, it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Given the relatively small area which would be subject to temporary loss; the wide availability of similar habitats outside the RLB; the proposed reinstatement of habitats; and the proposed translocation of any suitable habitat features for *Ectemnius ruficornis* and *Eluma caelata*, the assumed conservation objectives are not likely to be compromised. There is, therefore, no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site from Thanet Extension alone.

Noise and Visual Disturbance

11.5.10 The potential for noise and visual disturbance during construction and decommissioning to result in an AEoI relates to the following designated sites and qualifying features:

- Thanet Coast & Sandwich Bay SPA:
  - Ruddy turnstone (Non-breeding); and
  - European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar:
  - Ramsar Criterion 6 - Species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

Thanet Coast and Sandwich Bay SPA

11.5.11 The results of an analysis of non-breeding waterbird distribution in relation to the location of the proposed landfall are presented in the ES Volume 5, Annex 5-13: Intertidal Waterfowl Data Analysis in Relation to Onshore Works (Application Ref 6.5.5.13). This analysis examined the numbers and activity of non-breeding waterbirds within 250 m of the location of the proposed landfall, as recorded during surveys carried out in 2016-17. A distance of 250 m was used because significant disturbance beyond 250m (other than disturbance due to very loud infrequent noise such as driven/ percussive piling) is unlikely. The 250m distance was based on a combination of professional judgement and relevant literature, e.g. Cutts *et al*. (2009) and Collop *et al*. (2016).

11.5.12 During the 2016-17 surveys a peak count of 390 European golden plover was recorded within 250 m of the landfall in November 2016 with lower numbers recorded in the same area in December and February and none recorded in January or March. Although not present consistently, the area within 250 m of the landfall can therefore support significant numbers of European golden plover. No ruddy turnstone were recorded within 250 m of the landfall during the 2016-17 surveys nor were any ruddy turnstone recorded within 500m of the landfall with the peak count across Pegwell Bay as a whole during the survey period being just eight. Disturbance to ruddy turnstone is therefore not likely.

11.5.13 Peak European golden plover numbers at Pegwell Bay occur during the period October to March with much lower numbers recorded outside this period (based on WeBS data for the period 2000/01-15/16 - see ES Volume 4, Annex 5-4: Baseline Ornithology Report (Application Ref 6.5.5.4)). In order to avoid disturbance to potentially significant numbers of non-breeding European golden plover embedded mitigation (see Table 6.1) has been included that would involve a timing restriction on all construction and decommissioning works within intertidal habitats and at the shoreline. This would prevent any construction works taking place in these areas during the period October to March inclusive. In addition, any works within 250m of intertidal habitats that are undertaken between October and March but are not covered by seasonal restrictions and are in direct line of sight from intertidal habitats, e.g. works on the TJBs, will only take place following the erection of screening fencing. Furthermore, any driven/ percussive piling elsewhere within Pegwell Bay Country Park, e.g. if additional cofferdams are required to prevent the migration of contaminants, would be subject to a timing restriction and would not take place during the period October to March. HDD works (landfall option 1), if feasible, would also be subject to the same timing restriction.

11.5.14 The conservation objectives for the SPA require the maintenance of the population of each of the qualifying features and the distribution of the qualifying features within the site. The implementation of the embedded mitigation measures described above effectively removes the potential for significant noise and visual disturbance to non-breeding European golden plover and the site's conservation objectives will not be compromised. There is, therefore, no potential for AEoI to the qualifying non-breeding bird species for the Thanet Coast and Sandwich Bay SPA from Thanet Extension alone.

Thanet Coast and Sandwich Bay Ramsar

11.5.15 The potential for AEoI for ruddy turnstone was assessed above in respect of the Thanet Coast and Sandwich Bay SPA. In the absence of conservation objectives for the Ramsar site, the conservation objectives for the SPA are considered valid. On the basis of the assessment against the relevant conservation objectives for the SPA, as set out above, there is no potential for AEoI to the ruddy turnstone qualifying feature of the Thanet Coast and Sandwich Bay Ramsar from Thanet Extension alone.

Potential Disturbance due to Possible Displacement of Recreational Users from Pegwell Bay Country Park

11.5.16 The potential for disturbance due to possible displacement of recreational users from Pegwell Bay Country Park to result in an AEoI relates to the following designated sites and qualifying features:

- Thanet Coast & Sandwich Bay SPA:
  - Ruddy turnstone (Non-breeding); and
  - European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar:
  - Ramsar Criterion 6 - Species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

Thanet Coast and Sandwich Bay SPA

11.5.17 Although works at the shoreline will be subject to a timing restriction and will not take place during the period October to March, other works could take place within the country park during the more sensitive winter months. Disturbance to non-breeding European golden plover and ruddy turnstone is therefore possible if visitors are displaced from the country park to other more sensitive areas elsewhere within Pegwell Bay.

11.5.18 To examine the potential extent of possible displacement a desk-based study was undertaken, the results of which are presented in the ES Volume 3, Chapter 5: Onshore Biodiversity (Application Ref 6.3.5) and Volume 3, Chapter 4: Tourism and Recreation (Application Ref 6.3.4). As part of this study, data for the number of car parking tickets sold at Pegwell Bay Country Park were provided by KCC for both 2016 and 2017. Comparison of the data between years indicated no significant difference in the number of visitors between the period that construction works for the Nemo Link were taking place within the country park (April to September 2017) and the corresponding period in 2016. This strongly suggests that visitor numbers at the country park are not likely to be significantly affected by the proposed construction works, which would be of similar scale to the works for the Nemo Link.

11.5.19 The above notwithstanding, a precautionary approach has been adopted which assumes that some displacement of recreational users of the country park is possible. Consideration of a visitor study carried out in 2012 (Strategic Marketing, 2012) indicates that the majority of visitors to Pegwell Bay Country Park (61%) came from Cliffsend or the Thanet towns. 58% of visitors' main reason for visiting was to walk their dog(s); most planned to walk less than two miles, 91% came by car and 87% were repeat visitors. This suggests that any displacement is most likely to involve regular dog walkers, travelling by car from the north. It is therefore assumed that displacement is most likely to affect sites to the north of the country park with easy vehicular access. This assumption is supported by anecdotal information from the operator of the coffee stall in the country park car park (pers. comm., March 2018) who, despite the car parking data, suggested that visitors were displaced during construction works for the Nemo Link and went instead to the 'pirate ship' picnic site at Cliffsend or the Western Undercliff at Ramsgate. Intertidal habitats adjacent to both locations are readily accessible and are already subject to relatively high numbers of visitors (Duncan Watson, personal observation).

11.5.20 The main concern of Natural England is that any displaced dog walkers could utilise the intertidal habitats. It is considered very unlikely that displaced visitors would utilise the saltmarsh habitats adjacent to Pegwell Bay Country Park which contain deep, wet creeks and are very difficult to walk across. It is also considered unlikely that significant numbers of visitors would utilise the mudflats and sandflats, although some usage of these areas, particularly in the northern half of Pegwell Bay, close to the alternative car parks at Cliffsend and the Western Undercliff, is possible.

11.5.21 As a precaution, embedded mitigation has been proposed to discourage any displaced visitors from accessing intertidal habitats during the sensitive October to March period (see Table 6.1). The precise details of the measures to be employed would depend on the final design solution adopted, although at this stage it is considered likely that the measures would include the provision of additional signage and an Ecological Clerk of Works (or temporary warden/ natural ambassador) during the sensitive October to March period who would monitor visitor disturbance and would speak to visitors to discourage them from entering intertidal habitats, if required.

11.5.22 The conservation objectives for Thanet Coast and Sandwich Bay SPA include the maintenance of the population of each of the qualifying features and the distribution of the qualifying features within the site. Taking into account the low likelihood of visitor displacement, the location of the sites which visitors are most likely to be displaced to and the embedded mitigation, subject to natural change the population and distribution of the designated ruddy turnstone and European golden plover features will be maintained in the long-term. There is therefore no potential for AEoI to the qualifying features of the Thanet Coast and Sandwich Bay SPA from Thanet Extension alone.

Thanet Coast and Sandwich Bay Ramsar

11.5.23 The potential for AEoI for ruddy turnstone was assessed above in respect of the Thanet Coast and Sandwich Bay SPA. In the absence of conservation objectives for the Ramsar site, the conservation objectives for the SPA are considered valid. On the basis of the assessment against the relevant conservation objectives for the SPA, as set out above, there is no potential for AEoI to the ruddy turnstone qualifying feature of the Thanet Coast and Sandwich Bay Ramsar from Thanet Extension alone.

Accidental Pollution

11.5.24 The potential for accidental pollution of terrestrial habitats during construction to result in an AEoI relates to the following designated sites and the relevant features:

- Thanet Coast and Sandwich Bay Ramsar:
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates

11.5.25 The CoCP (Doc. Ref. 8.1) sets out the in-principle management and monitoring measures which will be implemented to avoid accidental spills and potential release of contaminants within the onshore environment. Final details will be implemented once the final design solution to be adopted has been agreed, Site Investigation works have been undertaken and detailed construction methodologies have been provided by the chosen contractor. These details will be secured via a CEMP and other SSMPs, each of which will be submitted to the relevant planning authorities, and other relevant stakeholders, for approval prior to works commencing. Construction will then take place in accordance with the agreed plans.

11.5.26 Although there are no published conservation objectives for the Ramsar, it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Following the implementation of the measures set out in the agreed CEMP and other SSMPs, the assumed conservation objectives are not likely to be compromised. There is therefore no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site as a result of accidental pollution of terrestrial habitats from Thanet Extension alone.

Spread of INNS

11.5.27 The potential for the spread of INNS within terrestrial habitats during construction to result in an AEoI relates to the following designated sites and the relevant features:

- Thanet Coast and Sandwich Bay Ramsar:
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates

11.5.28 The only INNS recorded during surveys to inform the EIA were Japanese knotweed (*Fallopia japonica*) and New Zealand pygmyweed (*Crassula helmsii*). Both species were recorded over 500 m away from Stonelees Nature Reserve, which is the only part of the onshore RLB in which wetland invertebrate assemblage species are likely to be present.

11.5.29 Measures to avoid the spread of INNS are detailed in the ES, Volume 3, Chapter 5: Onshore Biodiversity (Document Ref: 6.3.5) and in the CoCP (Doc. Ref. 8.1). The measures include a pre-construction survey and the avoidance of any stands of INNS, whether existing or identified during the pre-construction survey, wherever possible. If avoidance is not possible a detailed mitigation plan will be produced to ensure compliance with the relevant legislation. This will be detailed in the CEMP, which will be submitted to the relevant planning authorities, and other relevant stakeholders, for approval prior to works commencing. Construction will then take place in accordance with the agreed plan.

11.5.30 Although there are no published conservation objectives for the Ramsar, it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Given there are no known INNS within 500m of Stonelees Nature Reserve and following the implementation of the measures set out in the CoCP (Doc. Ref. 8.1), the assumed conservation objectives are not likely to be compromised. There is therefore no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site as a result of the spread of INNs within terrestrial habitats from Thanet Extension alone.

Operation and Maintenance

Disturbance/ Temporary Loss of Habitat

11.5.31 The potential for disturbance/ temporary loss of habitat during planned maintenance works to result in an AEoI relates to the following designated sites and the relevant features:

- Thanet Coast and Sandwich Bay Ramsar:
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates.

11.5.32 As stated in relation to construction and decommissioning, the three wetland invertebrate assemblage species with the potential to be present within or immediately adjacent to the RLB are only likely to be present in the Stonelees Nature Reserve section of the RLB. During the O&M phase joint pits within Stonelees Nature Reserve may be subject to up to eight visits per year, either on foot or using a light vehicle.

11.5.33 Embedded mitigation measures will be detailed in a TIMS (forming part of the detailed LEMP), which will be informed by a detailed invertebrate survey of affected areas and will be subject to agreement with the relevant planning authorities, in consultation with Natural England and other relevant stakeholders, prior to construction commencing. The precise selection of measures to be employed would depend on the results of the survey and the final design solution adopted, although at this stage it is considered likely that the measures during planned O&M works would be limited to the avoidance of suitable habitat. Areas of suitable habitat for each species, if present, are likely to be relatively small and therefore readily avoided during planned O&M works. Further details are provided in the Outline LEMP (Application Ref 8.7).

11.5.34 There are no published conservation objectives for the Ramsar site. However, it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Given the very small area which would be affected by planned maintenance, the very limited nature of planned maintenance works and the embedded mitigation, the assumed conservation objectives are not likely to be compromised. There is, therefore, no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site from Thanet Extension alone.

Noise and Visual Disturbance

11.5.35 The potential for noise and visual disturbance during O&M to result in an AEoI relates to the following designated sites and qualifying features:

- Thanet Coast & Sandwich Bay SPA:
  - Ruddy turnstone (Non-breeding); and
  - European golden plover (Non-breeding).
- Thanet Coast & Sandwich Bay Ramsar:
  - Ramsar Criterion 6 - Species/ populations occurring at levels of international importance: Ruddy turnstone (Non-breeding).

Thanet Coast and Sandwich Bay SPA

11.5.36 In order to avoid disturbance to potentially significant numbers of non-breeding European golden plover and ruddy turnstone embedded mitigation (see Table 6.1) has been included that would involve a timing restriction on any planned maintenance within intertidal habitats and at the shoreline. This would prevent any works taking place in these areas during the period October to March inclusive.

11.5.37 The conservation objectives for the SPA require the maintenance of the population of each of the qualifying features and the distribution of the qualifying features within the site. The implementation of the embedded mitigation measures described above effectively removes the potential for significant noise and visual disturbance to non-breeding European golden plover and ruddy turnstone and the site's conservation objectives will not be compromised. There is, therefore, no potential for AEoI to the qualifying non-breeding bird species for the Thanet Coast and Sandwich Bay SPA from Thanet Extension alone.

Thanet Coast and Sandwich Bay Ramsar

11.5.38 The potential for AEoI for ruddy turnstone was assessed above in respect of the Thanet Coast and Sandwich Bay SPA. In the absence of conservation objectives for the Ramsar site, the conservation objectives for the SPA are considered valid. On the basis of the assessment against the relevant conservation objectives for the SPA, as set out above, there is no potential for AEoI to the ruddy turnstone qualifying feature of the Thanet Coast and Sandwich Bay Ramsar from Thanet Extension alone.

Accidental Pollution

11.5.39 The potential for accidental pollution of terrestrial habitats during the O&M phase to result in an AEoI relates to the following designated sites and the relevant features:

- Thanet Coast and Sandwich Bay Ramsar:
  - Ramsar criterion 2: supports 15 British Red Data Book wetland invertebrates

11.5.40 As stated above, the three wetland invertebrate assemblage species with the potential to be present within or immediately adjacent to the RLB are only likely to be present in the Stonelees Nature Reserve section of the RLB. During the O&M phase joint pits within Stonelees Nature Reserve may be subject to up to eight visits per year, either on foot or using a light vehicle. The potential for accidental pollution events to take place during these visits is negligible.

11.5.41 As set out in the OLEMP (Doc. Ref. 8.7) the locations of any protected and notable species (including wetland invertebrate assemblage species, if present) that could potentially be adversely affected by planned inspections will be avoided as far as possible during planned maintenance. Any such locations will be specified in the detailed LEMP based on the most up to date information available at that time and locations would be updated, as required, throughout the O&M period via regular consultation with the Sandwich and Pegwell Bay National Nature Reserve site manager(s).

11.5.42 Although there are no published conservation objectives for the Ramsar, it is reasonable to assume that conservation objectives would include the maintenance of the populations and distribution of wetland invertebrate assemblage species and their supporting habitats. Given the negligible potential for accidental pollution to affect habitats for these species and the employment of embedded mitigation measures, the assumed conservation objectives are not likely to be compromised. There is therefore no potential for AEoI to the wetland invertebrate assemblage feature of Thanet Coast and Sandwich Bay Ramsar site as a result of accidental pollution during the O&M phase from Thanet Extension alone.

12 Assessment of Adverse Effect In-combination

12.1.1 Screening for designated sites and features in-combination is presented in section 8, essentially identifying the plans and projects to be considered for assessment. The assessment presented here draws on that presented within relevant topic specific chapters of the ES, tailored for the requirements of the RIAA, to enable the determination of AEoI in-combination to the features and effects screened in.

12.1.2 In assessing the potential for in-combination effects associated with Thanet Extension, it is important to bear in mind that some projects, predominantly those 'proposed' or identified in development plans etc. may or may not actually be taken forward. There is thus a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, relevant projects/ plans with consent and (if required) CfD (or similar) are more likely to contribute to in-combination impact with Thanet Extension (providing effect or spatial pathways exist), whereas projects/ plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

12.1.3 For this reason, all relevant projects/ plans considered in-combination alongside Thanet Extension have been allocated into 'Tiers', reflecting their current stage within the planning and development process. Where the tiering approach differs between receptor groups, this is noted in the relevant section. The tiering approach allows the in-combination impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. The definition of each tier is described in section 8, with the plans and projects screened in for further consideration here defined within Table 12.1: In-combination projects and maximum design scenario and Table 12.2 on a receptor by receptor basis.

12.1.4 For each plan/ project screened in, the in-combination maximum adverse scenario draws on the information presented in topic specific chapters of the ES. The aim is to identify, for each receptor group, the aspects of the plans, projects and programmes screened in to be assessed. Consideration is given to the following points:

- Level of detail available for project/ plans;
- Potential for an effect-pathway-receptor link;
- Potential for a physical interaction; and
- Potential for temporal interaction.

12.1.5 Table 12.1 below identifies, for all plans and projects screened in for consideration in-combination, the relevant receptor group(s), the maximum adverse scenario as it applies to that receptor group(s) and the relevant years within which the works are planned to occur. It is of note that, for a number of projects, insufficient information exists to provide a maximum adverse scenario, with that noted where relevant.

Table 12.1: In-combination projects and maximum design scenario

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
Offshore Wind Farm										
Pre-planning	Dunkirk	4							Insufficient information to enable assessment. Therefore, nothing to include in the in-combination maximum adverse scenario.	Unknown
In Planning	Courseulles-sur-mer	2							Not relevant – screened out of assessment based on screening criteria	Not relevant
	Dieppe-le Treport	2							The project, currently progressing through Public Inquiry (December 2018) is scheduled for commissioning in 2021 and therefore it is considered that all piling (and other noisy activity) will need to be completed well before then to enable that to occur. The pulic inquiry raised uncertainty to the process, hence the inclusion as Tier 2.	Prior to 2021
	East Anglia Norfolk Boreas	4							Scoping report gives offshore construction commencing in 2025. Construction window does not overlap with that of Thanet Extension and therefore no potential for in-combination effect with underwater construction noise. Therefore, nothing to include in the in-combination maximum adverse scenario for marine mammals. Offshore ornithology considered separately.	Installation 2025-2029
	Hornsea Project Three	3							Hornsea Project Three RIAA has two separate piling windows, the first 2022-2023 and the second 2029-2030. Piling at Thanet Extension is scheduled Q1 2021-Q2 2023 and therefore has the potential for temporal overlap with the first of the 2 Hornsea Project Three piling windows. Offshore ornithology considered separately.	WTG foundations 2022-2023 and 2029-2030
	Norfolk Vanguard East	3							The Vanguard Report to inform HRA considers foundation installation commencing at the earliest Q2 2024 and	Installation 2024-2028

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
	Norfolk Vanguard West	3							therefore after completion of piling at Thanet Extension. No information is available on other noisy activities. Offshore ornithology considered separately.	
	East Anglia ONE North	4							Project Scoping issued, with DCO to be submitted 2019-2020 but no construction dates provided. Construction window assumed to not overlap with that of Thanet Extension; therefore no potential for in-combination effect with underwater construction noise. Therefore, nothing to include in the in-combination maximum adverse scenario for marine mammals. Offshore ornithology considered separately.	DCO to be submitted 2020
	East Anglia TWO	4								DCO to be submitted 2019
	Fecamp – Seine-Maritime	2							The project is subject to legal challenges that are delaying construction, and resulting in significant uncertainty as regards the project description.	Unknown
	Hollandse Kust noord 1	2							Insufficient information to enable assessment. Therefore, nothing to include in the in-combination maximum adverse scenario.	Unknown
	Hollandse Kust noord 2	2								Unknown
	Hollandse Kust zuid 1 & 2	3								Unknown
	Hollandse Kust zuid 3 & 4	3								Unknown
Consented	Borssele 1 & 2, 3 & 4, 5	1							Maximum design scenario considers the longest duration of the piling phase for each of the projects. Where projects do not overlap but run consecutively, it is assumed that piling could occur at any point within the construction phase therefore giving the longest duration of a potential piling phase.	2020

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
	Dogger Bank Creyke Beck A & B	2 (marine mammals) 3 (offshore ornithology)							Maximum design scenario considers the longest duration of the piling phase for each of the projects. Where projects do not overlap but run consecutively, it is assumed that piling could occur at any point within the construction phase therefore giving the longest duration of a potential piling phase. Offshore ornithology considered separately.	Construction window 2021-2024
	Dogger Bank Teesside A									Construction window 2020 onwards for 6 years
	Sofia									Construction window 2020-2025
	East Anglia THREE	2 (marine mammals) 3 (offshore ornithology)							Maximum design scenario considers the longest duration of the piling phase for each of the projects. Where projects do not overlap but run consecutively, it is assumed that piling could occur at any point within the construction phase therefore giving the longest duration of a potential piling phase. Offshore ornithology considered separately.	From 2020 (marine mammals) all years (offshore ornithology)
	Firth of Forth (Seagreen) Alpha and Bravo	3							Consented but not implemented. Offshore ornithology considered separately.	All years
	Hornsea Project TWO	1 (marine mammals) 3 (offshore ornithology							Maximum design scenario considers the longest duration of the piling phase for each of the projects. Where projects do not overlap but run consecutively, it is assumed that piling could occur at any point within the construction phase therefore giving the longest duration of a potential piling phase. Offshore ornithology considered separately.	Construction window of January 2017 to December 2021; piling to occur at some point within that window but programmed Q1 2018-Q3 2021 (marine mammals) All years (offshore ornithology)

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
	Inch Cape	2							Consented but not implemented.	All years
	Mermaid	2							Insufficient information to enable assessment; what limited information is available indicates limited potential for a temporal overlap of construction. Therefore, nothing to include in the in-combination maximum adverse scenario.	2017-2019
	Moray Firth (Eastern DA)	2							Consented but not implemented.	All years
	Neart na Gaoithe	2							Consented but not implemented.	All years
	Seastar	2							Insufficient information to enable assessment. Therefore, nothing to include in the in-combination maximum adverse scenario.	Unknown
	Triton Knoll	1 (marine mammals) 3 (offshore ornithology)							Construction window assumed to not overlap with piling activity at Thanet Extension and therefore no potential for in-combination effect with underwater construction noise. Potential remains for overlap with geophysical surveys and UXO clearance (if required) at Thanet Extension. Offshore ornithology considered separately.	Construction window of 2017 to 2021; piling to occur at some point within that window but anticipated to be complete by the end of the summer season 2020 (marine mammals) All years (offshore ornithology)
Under construction (or constructed but not yet operational)	Hornsea Project ONE	1 (marine mammals) 2 (offshore ornithology)							Marine mammals: Piling window until (and including) summer 2019. UXO licensed until May 2019. Offshore ornithology: All years	Potential for overlap with UXO and or geophysical works

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
	East Anglia ONE	1 (marine mammals) 2 (offshore ornithology)							Marine mammals: Construction window extending into winter season 2018/19 and then summer season 2019 and therefore may overlap with works at Thanet Extension, should UXO or geophysical survey occur in 2019. Offshore ornithology: All years	Potential for overlap with UXO and or geophysical works
	Beatrice	1							Under construction (or constructed but not yet operational) Marine mammals: Construction window assumed to not overlap with that of Thanet Extension and therefore no potential for in-combination effect with underwater construction noise. Potential remains for overlap with geophysical surveys and UXO clearance (if required) at Thanet Extension. Offshore ornithology: All years	Marine mammals: Q1-Q2 2019 at Hornsea ONE only East Anglia ONE installation 2018 Ornithology: All years
Operational	Beatrice Demonstrator	1							Built, formerly operational but at present out of commission.	All years
	Blyth	1								
	Dudgeon	1							Operational.	
	EOWDC [Aberdeen]	1								
	Galloper	1								
	Greater Gabbard	1								
	Gunfleet Sands I & 2	1								

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
	Humber Gateway	1								
	Kentish Flats	1								
	Kentish Flats Extension	1								
	Lincs	1								
	London Array	1								
	Lynn and Inner Dowsing	1								
	Race Bank	1								
	Rampion	1								
	Scroby Sands	1								
	Sheringham Shoal	1								
	Teesside	1								
	Thanet	1								
	Westermost Rough	1								
Cable installation										
Constructed	Nemo interconnector	1							Benthic ecology: The Nemo replacement export cable will result in temporary habitat loss of 340,000 m^2 in UK waters (within 12 km of Thanet Extension) from the installation of up to two cables in one trench.	Submarine cable in UK waters installed 2017, construction complete during 2018

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
									If cable protection is used, the significance of the effect of long-term habitat loss from the Nemo interconnector cable has been assessed as minor in UK waters. Onshore biodiversity: The onshore elements of the Nemo project include the construction of a converter station occupying 4.85 ha and temporary habitat loss/ disturbance at the landfall and along a 2.1 km cable route. Offshore ornithology considered separately.	
Pre planning	Gridlink interconnector								Insufficient information available to enable determination of the project location relative to designated sites.	Unknown
Disposal Area										
Open	Nemo Disposal Site B	1							The Nemo Interconnector cable has permission to use three disposal sites, with the two sites screened into this cumulative effects assessment having a total permitted disposal volume of 94,308 m^3. The use of the Pegwell Bay and Ramsgate Harbour disposal sites is primarily for the dumping of sediment removed during maintenance dredging. The use of these sites is intermittent and the volumes used are unknown in advance and therefore it is not possible to determine if the use of the sites will overlap with impacts from the construction of Thanet Extension. However, while the volumes are likely to be greater, the impacts are likely to be similar to those for the deposition of the drilling arisings predicted for Thanet Extension.	2017
	Nemo Disposal Site C	1								
	Pegwell Bay	2								Ongoing (dates not known in advance)
	Pegwell Bay B	2								
	Ramsgate Harbour Site A	2								
	Ramsgate Harbour Site B	2								
Active	Ramsgate Harbour Maintenance dredging (water injection)	1							Maintenance dredging is currently being undertaken within Ramsgate Harbour, using a water injection method (http://www.portoframsgate.co.uk/approach/notice-to-mariners/2019/062019/) with the works advertised as occurring from w/c 31st December 2018 for four weeks.	Q1 2019

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
Other Onshore Developments										
In planning	Manston Airport Re-opening and Redevelopment	3							The ES (AFW, 2018) states that the airport will be upgraded to include the following principal components: • Runways and taxiways suitable for the take-off and landing of a broad range of cargo aircraft; • An area for cargo freight operations able to handle at least 10,000 movements per year and associated infrastructure, including: a new Air Traffic Control (ATC) tower; a fire station; and a fuel farm; and Facilities for other airport related developments, including: a passenger terminal and associated facilities; 19 cargo stands; 4 passenger stands; 3 stands associated with the recycling facility; an aircraft teardown and recycling facility; a flight training school; a base for at least one passenger carrier; a fixed base operation for executive travel; and business facilities for airport related organisations.According to the ES, although the development will discharge treated water into Pegwell Bay, following appropriate design, the implementation of environmental measures during construction and regulation through an Environmental Permit, effects will be negligible. Construction disturbance to European golden plover (a qualifying species for the Thanet Coast and Sandwich Bay SPA) will be negligible on the basis that the site and surrounding area is not regularly used by the species and there is extensive alternative inland feeding habitat. Operational disturbance to Thanet Coast and Sandwich Bay SPA and Ramsar qualifying bird species caused by bird-scaring devices and aircraft noise will not be significant owing to the site and surrounding area not being regularly used by the species, the intervening distance (between the site and Pegwell Bay) and expected habituation.	DCO application was submitted in July 2018 and examination is in progress. If consented, construction will be phased and would take place between 2018 and 2036. The airport is due to re-open in Q4 2020.

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
In planning	Stone Hill Park Mixed use development, Manston Airport[86]	3							The ES (WSP, 2018) states that the proposed development would include the comprehensive redevelopment of the Manston Airport site involving the demolition of existing buildings and structures, removal of hard standing and associated infrastructure, partial retention of runway for airport use, and provision of mixed use development. According to the ES, although the development will discharge surface water into Pegwell Bay, following the implementation of mitigation measures, effects will not be significant. Based on 2015-16 bird survey data, when no European golden plover were recorded, the site does not represent functionally linked land in respect of the Thanet Coast and Sandwich Bay SPA European golden plover population. There will therefore be no direct impacts on SPA birds. Residential development could lead to an increase in recreational pressure on the Thanet Coast and Sandwich Bay SPA and Ramsar but following the implementation of mitigation measures this is unlikely to be significant. Mitigation measures will include a combination of on-site provision of open space for recreation, financial contributions to wardening at European sites and commitments to further monitoring.	A planning application was submitted in May 2018 but has yet to be determined. If consented, the site would be developed in phases. Construction and demolition is due to commence in 2019 and is likely to be completed in around 2039.
Consented	Mixed use development, Discovery Park, Sandwich	1							The development includes: demolition of some existing buildings (and associated infrastructure); change of use of some existing buildings; the provision of new commercial and residential development; associated site	Outline consent granted 2014, completion date unknown.

[86] Note that the Manston Airport Re-opening and Redevelopment proposal and the Stone Hill Park proposal occupy the same site and only one of these development proposals will be able to be consented.

Status	Project/ Plan Name	Tier	Relevant Receptor						Maximum Design Scenario	Relevant Years
			Intertidal and subtidal	Harbour porpoise	Harbour Seal	Grey Seal	Offshore ornithology	Onshore Biodiversity		
									preparation/enabling, infrastructure, and landscaping works; and provision of car parking. The site lies adjacent to the Thanet Coast and Sandwich Bay SPA and Ramsar. According to the ES and Updated Information to inform Appropriate Assessment (Buro Happold, 2014a and b) pollution and noise disturbance will be avoided by mitigation. Residential development could lead to an Increase in recreational pressure but this is not likely to be significant after mitigation, which includes provision of 20ha open space and a contribution to wardening and monitoring at Pegwell Bay and Sandwich.	
Under construction	Richborough Connection Project	1							The project comprises a 400kV electricity transmission connection between Richborough and Canterbury. National Grid (2016) identified possible effects resulting from collision, disturbance and displacement to European golden plover forming part of the Thanet Coast and Sandwich Bay SPA population, which use fields along the route for foraging. Embedded mitigation, including timing restriction in sensitive areas, controls on lighting and noise and use of screening fencing, is included to reduce disturbance and the assessment concluded that there would be no significant effects. Note that there is no potential for collision impacts resulting from Thanet Extension so in-combination effects due to collision are not possible.	Construction of the new line was completed in November 2018. Removal of the old line is due to be completed in 2020.
Operational	Biomass CHP Plant, Discovery Park, Sandwich	1							The development comprises a biomass CHP Plant with an electrical output capacity of 12-15 MW and a wood fuel preparation area covering a total area of approximately 4 hectares. The site is within 50 m of the Thanet Coast and Sandwich Bay SPA and Ramsar. The operation of the site will result in operational noise, although the operational noise assessment for the project concludes that there are no LSE for SPA birds.	Operational from September 2018.

12.1.7 Table 12.2 below draws on the above information, to determine the potential for an in-combination effect. Essentially, for a plan or project to have a potential in-combination effect with Thanet Extension, there needs to be sufficient information on which to base an assessment and the construction timeframe needs to be such that there is potential for temporal overlap of effect(s). That potential is identified, for each receptor group, in Table 12.2 below.

Table 12.2: Receptor Groups and the effects to assess in-combination

Project	Potential Effect	Timing of Effect	Summary	Relevant Aspect of Thanet Extension		
				Construction	Operation	Decommissioning
Sites primarily designated for subtidal and benthic intertidal habitats						
Nemo interconnector	Temporary habitat loss	2017/ 2018	No temporal overlap therefore no in-combination effect	N/A	N/A	N/A
	SSC and deposition	2017/ 2018		N/A	N/A	N/A
	Potential for permanent habitat loss	Ongoing	Only if cable protection is used within a designated site. Not known to date.	None identified		
Open disposal ground/ maintenance dredging	SSC and deposition	Ongoing	The use of these sites is intermittent and the volumes used are unknown in advance and therefore it is not possible to determine if the use of the sites will overlap with impacts from the construction of Thanet Extension. The current maintenance dredging works in Ramsgate Harbour is due to be completed by the end of January 2019.	N/A	N/A	N/A
Sites primarily designated for Marine Mammals						
Courseulles-sur-mer	Underwater noise	Unknown	Project lies beyond the maximum screening range for marine mammals with respect to all designated sites screened in for the project alone and therefore is not relevant ot the in-combination assessment	N/A	N/A	N/A

Project	Potential Effect	Timing of Effect	Summary	Relevant Aspect of Thanet Extension		
				Construction	Operation	Decommissioning
East Anglia Norfolk Boreas East Anglia ONE North East Anglia TWO Fecamp-Seine Maritime Hollandse Kust noord 1 Hollandse Kust noord 2 Hollandse Kust zuid 1 & 2 Hollandse Kust zuid 3 & 4 Mermaid Seastar Dunkirk Dieppe-le-Treport	Underwater noise	Unknown or outwith the timeframe for Thanet Extension	No known temporal overlap therefore no in-combination effect	N/A	N/A	N/A
East Anglia THREE	Underwater noise	From 2020	Potential for temporal overlap	SNS cSAC/SCI (harbour porpoise) Transboundary sites for harbour seals (Voordelta, Vlaamse Banken) Transboundary sites for grey seals (Bancs des Flandres, Vlakte van de Raan, Vlaamse Banken, Voordelta, SBZ1, SBZ2, SBZ3)	N/A	N/A
Borssele 1 & 2, 3 & 4, 5	Underwater noise	Piling window ends prior to offshore construction starting at Thanet Extension	Potential for overlap with Thanet Extension pre-construction activities	SNS cSAC/SCI (harbour porpoise) Transboundary sites for harbour seals (Bancs des Flandres, Vlakte van de Raan, Voordelta, Vlaamse Banken)	N/A	N/A

Project	Potential Effect	Timing of Effect	Summary	Relevant Aspect of Thanet Extension		
				Construction	Operation	Decommissioning
				Transboundary sites for grey seals (Bancs des Flandres, Recifs Gris-Nez Blanc Nez, Vlakte van de Raan, Vlaamse Banken, Voordelta, SBZ1, SBZ2, SBZ3, Ridens et dunes hydrauliques)		
Dogger Bank Creyke Beck A & B Dogger Bank Teesside A Sofia Hornsea Project TWO Hornsea Project Three	Underwater noise	Piling window includes that for Thanet Extension	Potential for construction window overlap	SNS cSAC/SCI (harbour porpoise)		
Hornsea Project ONE Triton Knoll East Anglia ONE	Underwater noise	Piling window ends prior to offshore construction starting at Thanet Extension	Potential for overlap with Thanet Extension pre-construction activities	SNS cSAC/SCI (harbour porpoise)	N/A	N/A
Norfolk Vanguard	Underwater noise	Piling window starts significantly after offshore construction starting at Thanet Extension	No relevant activity currently in the pulic domain	N/A	N/A	N/A
Sites primarily designated for Offshore Ornithology						
Offshore cables (Nemo)	Direct disturbance and displacement	In the construction phase of these projects	Potential for temporal overlap if they are constructed at the same time	Outer Thames Estuary SPA	N/A	N/A
OWFs (listed in Table 8.4)	Direct disturbance and displacement	In the construction and O&M phase of Thanet Extension and the OWFs	OWFs affect red-throated diver populations in the UK part of the southern North Sea	Outer Thames Estuary SPA	Outer Thames Estuary SPA	Outer Thames Estuary SPA

Project	Potential Effect	Timing of Effect	Summary	Relevant Aspect of Thanet Extension		
				Construction	Operation	Decommissioning
OWFs (listed in Table 8.4)	Collision risk	In the operational phase of Thanet Extension and the OWFs	OWFs affect seabird populations from a series of SPA and Ramsar sites along the western seaboard of the North Sea	N/A	Alde-Ore Estuary SPA Alde-Ore Estuary Ramsar Flamborough and Filey Coast SPA St Abb's Head to Fast Castle SPA	N/A
Sites primarily designated for Onshore Biodiversity						
Nemo interconnector	Temporary habitat loss	2017-18	No temporal overlap therefore no in-combination effect	N/A	N/A	N/A
	Disturbance during Construction	2017-18	No temporal overlap therefore no in-combination effect	N/A	N/A	N/A
	Displacement of recreational visitors from Pegwell Bay Country Park	2017-18	No temporal overlap therefore no in-combination effect	N/A	N/A	N/A
	Accidental pollution during Construction	2017-18	No temporal overlap therefore no in-combination effect	N/A	N/A	N/A
Biomass CHP Plant, Discovery Park, Sandwich	Disturbance due to operational noise	2018 onwards	Temporal overlap with operation of Thanet Extension likely	N/A	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar	N/A
Mixed use development, Discovery Park, Sandwich	Displacement of recreational visitors from Pegwell Bay Country Park	Once residential development has been constructed	Temporal overlap with Thanet Extension possible	Thanet Coast and Sandwich Bay SPA	N/A	Thanet Coast and Sandwich Bay SPA

Project	Potential Effect	Timing of Effect	Summary	Relevant Aspect of Thanet Extension		
				Construction	Operation	Decommissioning
				Thanet Coast and Sandwich Bay Ramsar		Thanet Coast and Sandwich Bay Ramsar
	Accidental pollution during Construction	Construction timing not known but assumed to be complete prior to decommissioning of Thanet Extension	Temporal overlap with Thanet Extension possible	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar	N/A	N/A
Richborough Connection Project	Disturbance during construction	2018-2021	Temporal overlap with construction of Thanet Extension possible	Thanet Coast and Sandwich Bay SPA	N/A	N/A
	Displacement during operation	2019 onwards	Temporal overlap with construction and operation of Thanet Extension possible	Thanet Coast and Sandwich Bay SPA	Thanet Coast and Sandwich Bay SPA	N/A
	Accidental pollution during construction	2018-2021	Temporal overlap with construction of Thanet Extension possible in respect of the removal of the old line	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar	N/A	N/A
Manston Airport Re-opening and Redevelopment	Disturbance during operation (from aircraft)	2020 onwards	Temporal overlap with construction and operation of Thanet Extension possible	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar
	Accidental pollution during construction	2019-2036	Temporal overlap with construction and operation of Thanet Extension possible	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar	N/A	N/A
	Displacement of recreational visitors from Pegwell Bay Country Park	Once residential development has been constructed (assumed 2020 onwards)	Temporal overlap with Thanet Extension possible	Thanet Coast and Sandwich Bay SPA	N/A	Thanet Coast and Sandwich Bay SPA

Project	Potential Effect	Timing of Effect	Summary	Relevant Aspect of Thanet Extension		
				Construction	Operation	Decommissioning
Stone Hill Park Mixed-use Development, Manston[87]				Thanet Coast and Sandwich Bay Ramsar		Thanet Coast and Sandwich Bay Ramsar
	Accidental pollution during construction	2019-2039	Temporal overlap with construction and operation of Thanet Extension possible	Thanet Coast and Sandwich Bay SPA Thanet Coast and Sandwich Bay Ramsar	N/A	N/A

[87] Note that the Manston Airport Re-opening and Redevelopment proposal and the Stone Hill Park proposal occupy the same site and only one of these development proposals will be able to be consented.

12.1.8 Following the identification of the plans and projects with the potential to result in an AEoI in-combination with Thanet Extension, the assessment is made below. The information is presented according to the following receptor groupings:

- Subtidal and Benthic Intertidal Habitats;
- Marine Mammals;
- Offshore Ornithology; and
- Onshore Biodiversity.

12.2 Subtidal and Benthic Intertidal Habitats

12.2.1 No plans or projects have been screened in for in-combination assessment for subtidal and benthic intertidal habitats as there is no temporal overlap or the chances of any temporal overlap between those plans and projects identified in Table 12.2. Specifically, Nemo Interconnector has been fully installed and as such there will be no overlap with construction activities on this project and the disposal sites identfieid for Nemo Interconnector were for construction material and as such will also cease to be active. Additionally, the remaining disposal sites are primarily for dredging at Ramsgate harbour and it is highly unlikely on the basis of the proximity of the cable route to the harbour that any dredging works would occur during cabling installation or operational works on Thanet Extension. Therefore there will be no AEoI from Thanet Extension in-combination with other plans or projects on the subtidal and benthic intertidal habitats screened in for assessment.

12.3 Marine Mammals

12.3.1 A description of the significance of potential in-combination effects upon the receptors grouped under 'marine mammals' is provided below, drawing on Volume 2, Chapter 7: Marine Mammal (Application Ref 6.2.7).

Construction and Decommissioning

Accidental Pollution

12.3.2 The potential for an AEoI in-combination as a result of accidental pollution on marine mammals during construction and decommissioning relates to the following designated sites and the relevant feature (i.e. those features screened in for LSE). The potential for LSE during decommissioning would be similar to, and potentially less than, those outlined in the construction phase.

- Southern North Sea cSAC/SCI (harbour porpoise); and
- Bancs des Flandres SCI (harbour porpoise, harbour seal and grey seal).

12.3.3 The potential for accidental pollution to affect marine mammals was not considered in the ES (Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7), given the inclusion of the following in the project specific mitigation table (Table 7.15):

'A Project Environmental Management Plan (PEMP) will be produced and followed to cover the construction and O&M phases. This will also incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. MMO, Maritime and Coastguard Agency (MCA) and the project site co-ordinator). A decommissioning programme will be developed to cover the decommissioning phase. The purpose of the measures to be implemented ensure that potential for contaminant release is strictly controlled and therefore provides protection to marine life across all phases of the life of the project.'

12.3.4 The implementation of the PEMP, produced in consultation with Natural England and provided for in the DCO as part of the standard dML requirements, enabled the conclusion in section 11, for the project alone, that there is, therefore, no AEoI to the marine mammals in relation to accidental pollution from Thanet Extension. An equivalent requirement to address the risk of accidental pollution is a standard aspect of all offshore wind farm projects. It can therefore be concluded that the requirement for such plans for all relevant projects results in a conclusion for the project in-combination of, subject to natural change, no AEoI and that the marine mammal features will be maintained in the long term with respect to the potential for accidental pollution.

Underwater Noise

12.3.5 The potential for underwater noise during construction to result in an AEoI in-combination with Thanet Extension relates to the following designated sites and the relevant features (based on the screening distance between the designated site and the project):

- SNS cSAC/SCI (harbour porpoise);
- Transboundary sites for grey seals (Bancs des Flandres, Recifs Gris-Nez Blanc-Nez, Vlakte van de Raan, Vlaamse Banken, Voordelta, SBZ1, SBZ2, SBZ3 and Ridens et dunes hydrauliques du détroit du Pas-de-Calais) (9 sites); and
- Transboundary sites for harbour seals (Bancs des Flandres, Recifs Gris-Nez Blanc-Nez, Vlakte van de Raan, Voordelta and Vlaamse Banken) (five sites).

12.3.6 The remaining transboundary sites screened in for LSE in relation to Thanet Extension alone lie further than the species specific screening range from all the projects screened in for assessment (see Table 12.1, which identifies those projects with potential for a temporal overlap with relevant works at Thanet Extension) and there is, therefore, no potential for an in-combination effect with the following sites:

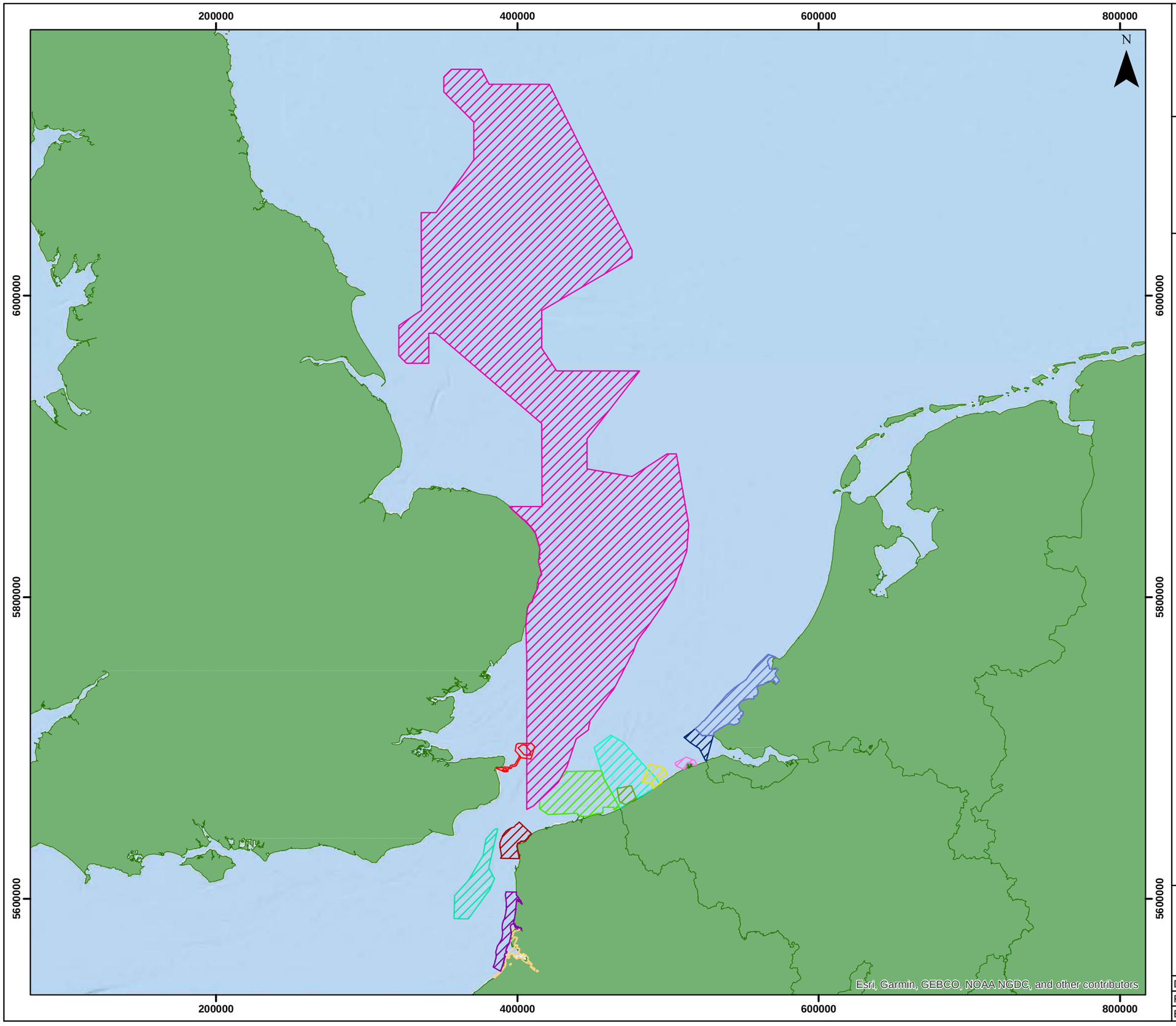
- Bancs des Flandres SCI (screened out for harbour porpoise only);
- Baie de Canche et couloir des trois estuaires (screened out for harbour seal and grey seal);
- Estuaires et littoral picards (baies de Somme et d'Authie) (screened out for harbour seal and grey seal); and
- Ridens et dunes hydrauliques du détroit du Pas-de-Calais (screened out for harbour seal only).

12.3.7 The plans and projects identified in Table 12.2 above with the potential to contribute to an in-combination effect on one or more designated site are as follows, together with the relevant species:

- East Anglia THREE, Tier 2, works from 2020 (harbour porpoise, harbour seal and grey seal);
- Borssele 1 & 2, 3 & 4, 5, Tier 1, piling in 2020 (harbour porpoise, harbour seal and grey seal);
- Dogger Bank Creyke Beck A & B, Tier 2, construction window 2021-2024 (harbour porpoise);
- Dogger Bank Teesside A, Tier 2, construction window 2020 onwards for 6 years(harbour porpoise);
- Sofia, Tier 2, construction window 2020-2025(harbour porpoise);
- Hornsea Project TWO, Tier 1, construction Q1 2018-Q3 2021 (harbour porpoise);
- Hornsea Project Three, Tier 3, piling 2022-2023 and 2029-2030 (harbour porpoise);
- East Anglia ONE, Tier 1, piling and UXO extended to end September 2019 (harbour porpoise, harbour seal and grey seal);
- Hornsea Project ONE, Tier 1, piling and UXO licensed through at least part of the summer season 2019 (harbour porpoise); and
- Triton Knoll, Tier 1, construction anticipated to be finalised end of summer season 2020 (harbour porpoise).

12.3.8 Effectively for a project to be screened in for in-combination assessment, there needs to be potential for relevant works (i.e. noisy activity) to occur within the same timeframe as relevant works at Thanet Extension, with these identified in Table 12.2. The sites/features included in-combination are then those that are located within the species specific screening distance from one or more of the projects identified for in-combination assessment (with the distances between sites/projects provided in Table 8.2).

12.3.9 The locations of these designated sites, in relation to Thanet Extension, are shown in Figure 12.1. The locations of these plans and projects are depicted in Figure 12.2.



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THANET EXTENSION OFFSHORE WIND FARM

Figure 12.1

Sites Identified for Marine Mammals in Relation to Thanet Extension

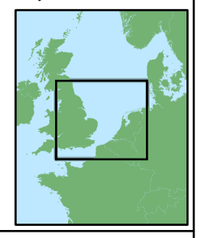
Legend

- Offshore Red Line Boundary

Identified Designated Sites

- Baie de Canche et couloir des trois estuaires
- Bancs des Flandres
- Estuaires et littoral picards (baies de Somme et d'Authie)
- Ridens et dunes hydrauliques du détroit du Pas-de-Calais
- Récifs Gris-Nez Blanc-Nez
- SBZ 1 / ZPS 1
- SBZ 2 / ZPS 2
- SBZ 3 / ZPS 3
- Southern North Sea
- Vlaamse Banken
- Vlakte van de Raan
- Voordelta

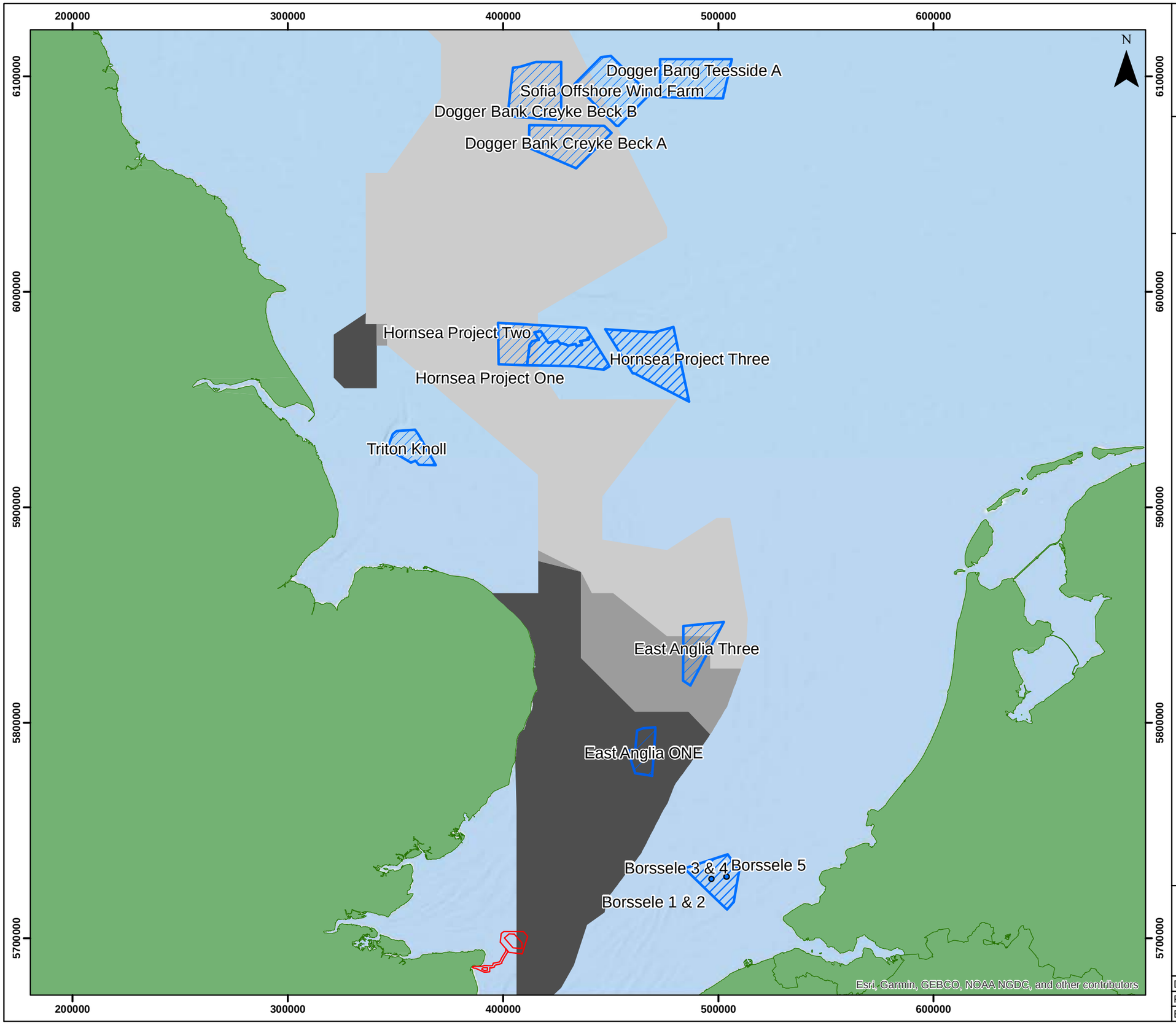
Datum: ETRS 1989
Projection: UTM31N



1:2,500,000 0 25 50 km 0 10 20 nm

Drg No	Fig12.1_MarineMammalsSites		
Rev	0.1	Date	01/02/2019
By	RM	Layout	N/A

Figure 12.1



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THANET EXTENSION OFFSHORE WIND FARM

Figure 12.2

Other OWFs for Consideration In-Combination with Thanet Extension

Legend

- Offshore Red Line Boundary
- SNS cSAC Summer and Winter Area
- SNS cSAC Summer Area
- SNS cSAC WInter Area
- Borssele Wind Farms (Mid-Points)
- Other Offshore Wind Farms

Datum: ETRS 1989
Projection: UTM31N

1:1,750,000 0 10 20 km 0 10 20 nm

Drg No	Fig12.2_OtherOWFs		
Rev	0.1	Date	01/02/2019
By	RM	Layout	N/A

Figure 12.2

12.3.10 Timeframes for decommissioning are highly uncertain for all projects and therefore an assessment of the potential for an in-combination effect during decommissioning cannot be made at this time. However, it is likely that the potential for effect during decommissioning would be less than that during construction, and would be assessed in line with the regulatory requirements at the time.

12.3.11 As highlighted in the AEoI for the project alone, there are a number of potential sources of underwater noise associated with construction of an OWF. Comment on these for the purposes of the in-combination assessment is provided below:

- UXO clearance – planned and licensed UXO activity associated with projects screened in is included (where that information is in the public domain)[88];
- Percussive piling – to be carried through to the assessment for projects screened in in-combination;
- Increased vessel traffic – given the small and localised increase above baseline in vessel movements associated with construction of an offshore wind farm, existing levels of shipping across the region, known tolerance of harbour porpoise, harbour seal and grey seal to shipping (see section 8), together with the variable timing for construction of projects screened in for in-combination assessment when compared to Thanet Extension and the widely dispersed nature of the projects to consider in-combination, vessel traffic has not been taken forward to assessment in-combination as it is considered that there is no potential for an in-combination effect above trivial;
- Cable laying, seabed dredging and drilling for foundation installation – as noted in section 8, such activities would result in a highly localised and short-term level of effect only, with these therefore not taken forward in-combination as no pathway exists for an in-combination effect;
- Geophysical survey –planned geophysical survey included within the screening range (where that information is in the public domain)[89]; and
- ADDs – no LSE applies alone, with the small scale, temporary and intermittent nature of the effect being insufficient to result in any meaningful in-combination effect. Therefore, ADDs have not been taken forward to the in-combination assessment.

12.3.12 Focusing the assessment in-combination on percussive piling noise (together with project related sources of underwater noise, namely UXO clearance, geophysical survey and piling) is supported by the ES, which found that '*during the offshore construction of Thanet Extension, the main source of cumulative impacts from underwater noise is likely to be from piling operations from other projects, plans and activities'*. The ES has a similar focus on piling noise for the cumulative assessment for marine mammals.

12.3.13 The potential for underwater noise to result during construction of Thanet Extension, together with the sensitivity of harbour porpoise, harbour seal and grey seal to such noise, has been discussed in section 11.3 as part of the assessment of AEoI alone, with that information not repeated here.

12.3.14 The assessment in-combination is made below, initially for harbour porpoise and then for harbour seal and grey seal.

Potential for an In-combination Effect on Harbour Porpoise from Underwater Noise

12.3.15 Table 12.3 below provides further information on the potential for temporal in-combination effects in relation to the above plans and projects screened in for assessment in relation to harbour porpoise only and is therefore limited to the SNS cSAC/SCI, as the Bancs des Flandres SCI has been screened out of the in-combination assessment for harbour porpoise (no other projects, with works scheduled to occur within the relevant timeframe, are located within the 26km screening distance of the site).

[88] It is noted that previous projects undertaking RIAA within or in close proximity to the SNS cSAC/SCI have made consideration of clearance occurring on a sporadic basis across the region (eg OSPAR based data https://www.ospar.org/work-areas/eiha/munitions). However, as has previously been concluded, such clearance is adhoc and expected to decrease from recent levels. That view is reinforced by the publication of the 2016 data – which demonstrates a reduction in UXO of 653 in 2014 to 359 in 2016. There is no certainty that clearance will occur within the relevant timeframe and, if it does, for that clearance to occur within 26 km of the SNS cSAC/SCI boundary (noting that 5 were in range in 2014 and just 2 in 2016, not withstanding the seasonal aspect). Therefore such clearance has been considered de minimis in this context and excluded from the assessment.

[89] Further, the BEIS database which provides information on planned oil and gas related geophysical surveys does not extend sufficiently far into the future to enable such surveys to be included https://www.gov.uk/guidance/oil-and-gas-environmental-data#pets-applications

Table 12.3: Temporal overlap with Thanet Extension of plans and projects considered in-combination (harbour porpoise) (winter season only[90])

Project	Temporal Overlap with Construction Window					Relevant Activity
	Winter Season (2018-2019)	Winter Season (2019-2020)	Winter Season (2020-2021)	Winter Season (2021-2022)	Winter Season (2022-2023)	
Thanet Extension						Seismic survey (currently uncertain requirement for, timing and duration but would precede the piling and UXO clearance) to be undertaken 2019 at the earliest (but 2020 being more likely)
Thanet Extension						UXO clearance (currently uncertain requirement for, timing and duration but would precede the piling, likely to be within 6 months of piling) to be undertaken 2019 at the earliest (but 2020 being more likely)
Thanet Extension						Construction piling. Offshore construction to start in 2021
Tier 1 (*Grey shading represents the construction window within which the activity may occur*)						
Borssele 1, 2, 3, 4 & 5						Foundation piling (2020)
East Anglia ONE						Piling and UXO extended to end September 2019
Triton Knoll						Seismic survey
Triton Knoll						UXO clearance
Triton Knoll						Foundation piling
Hornsea Project One						Piling and UXO licensed through at least part of the summer season 2019
Hornsea Project Two						Piling programmed Q1 2018-Q3 2021
Tier 2 (*Grey shading represents the construction window within which the activity may occur*)						
Dogger Bank Creyke Beck A&B						Consent issued but no CFD. Construction window 2021-2024

[90] As Thanet Extension is located at least 229 km from the summer extents of the SNS cSAC/SCI and therefore, as concluded in the assessment of AEoI for the project alone, Thanet Extension can only contribute to an effect on the SNS cSAC/SCI during the winter season. The in-cpombination assessment is therefore limited to the winter seasons within which relevant works may occur at Thanet Extension.

Project	Temporal Overlap with Construction Window					Relevant Activity
	Winter Season (2018-2019)	Winter Season (2019-2020)	Winter Season (2020-2021)	Winter Season (2021-2022)	Winter Season (2022-2023)	
Dogger Bank Teesside A						Consent issued but no CFD. Construction window 2020 onwards for 6 years
Sofia						Consent issued but no CFD. Construction window 2020-2025
East Anglia THREE						Consent issued but no CFD. Offshore construction would begin in 2020 at the earliest
Tier 3 (*Grey shading represents the construction window within which the activity may occur*)						
Hornsea Project THREE						Piling 2022-2023 and 2029-2030
Tier 4 (*None identified*)						

12.3.17 There is strong presumption of certainty that Tier 1 projects will proceed to construction on the specified timeframe and scale, with these projects having achieved consent, CfD and preparing for construction along the scale and timeframe specified. Thanet Extension is progressing on the timeframe and scale specified by VWPL, as included within the assessment process as the project design and project programme (section 5), and therefore can be afforded the same level of certainty within the in-combination assessment here.

12.3.18 For Tier 2, 3 and 4 projects, there is a much lower degree of certainty in terms of project programme timeframe and project scale. Whilst it is recognised that the planned construction windows of the Tier 2, 3 and 4 wind farm projects, where publicly available, may overlap with (and may extend beyond) the construction window of Thanet Extension, it is acknowledged, in common with all such projects with such a large construction window during the planning process and prior to securing a Contract for Difference (CfD), that actual construction will last for a proportion of the total construction window and that in reality the actual construction window may shift further. In addition, it is not uncommon for the scale of a project to change following consent or achieving CfD, for example a reduced number of WTGs (potentially with an increased capacity per WTG) may be progressed to final scheme design.

12.3.19 It is considered that given the stage these projects have reached, and the remaining stages to complete, that none of the Tier 2, 3 or 4 projects will actually construct during the same timeframe as Thanet Extension and that uncertainty remains regarding the final scheme design for these projects (albeit that the final design will fall within the maximum assessed and consented for each project). The reasons for this are outlined below:

- None of the Tier 2, 3 or 4 projects have to date (December 2018) secured a CfD;
- Based on current government announcements, the next CfD round will commence in May 2019);
- A total capacity cap of 6GW has been applied in the 2019 CfD round for all projects coming forward (including all sources of energy, not just offshore wind), all of which would be required in full by the Tier 2 projects to achieve their full consented capacity (and would assume that other projects currently progressing through planning, together with other industries also anticipated to bid, would be unsuccessful in the bidding process). The potential for Tier 2 projects is further limited by the effective cap on staged projects (which presumably includes the Dogger projects and Sofia) of 1.5GW; and
- Post CfD works typically take in excess of 2 years before construction starts, with construction typically commencing onshore prior to progressing seawards.

12.3.20 CfD is essentially the method through which certainty is provided regarding the price paid for electricity generated by a project. The most recent CfD round (termed the second round) started on 3rd April 2017, with the outcome posted on 11th September 2017. In reality, a project will not currently progress through to final scheme design without its funding mechanism in place – essentially, without the CfD, there cannot be any certainty that the scheme will actually come forward. Once the project has its CfD in place, it can go through the further steps required before construction can commence. These include Final Investment Decision (FID), contractor procurement, final scheme design etc as well as addressing all the necessary pre-commencement commitments contained within the DCO. Experience has shown these works post CfD award typically take in excess of two years; for example, the CfD for East Anglia ONE was awarded in 2015 and the CfD for Hornsea ONE was awarded in 2014, both of which started piling(during Q1 2018. Government announcements currently indicate the next CfD round will occur in May 2019 and based on previous experience would indicate decisions late 2019. Onshore construction of these projects is therefore unlikely to commence until late 2021 at the earliest, with offshore construction to follow – provided projects achieve CfD and to the full capacity consented.

12.3.21 For Tier 2 projects, therefore, there is significant uncertainty regarding the timeframes for construction and the final scheme design, both of which will be heavily influenced by the need for CfD and Final Investment Decision (FID). For Tier 3 and 4 projects, further uncertainty exists as these are pre-consent and/ or pre application projects.

12.3.22 Taking these above factors into consideration, even should all these projects achieve consent followed by CfD for the full MW sought in the next CfD round (bearing in mind that CfD is again capped to a maximum of 1,500 MW for phased projects), it is reasonable to conclude that there is a high degree of certainty that piling at all these projects will not overlap with piling and/ or UXO clearance undertaken at Thanet Extension.

12.3.23 Given the extreme uncertainty regarding the potential for the Tier 2, 3 and 4 offshore wind farm projects to come forward in their current form and at a timescale where piling would overlap with UXO clearance and/ or piling activity at Thanet Extension, the in-combination assessment considers the contribution from these projects and activities separately to that of Tier 1 projects – with that consideration caveated as a result of the uncertainty. Certainty in the conclusions of the assessment is provided for by the associated Site Integrity Plan or SIP (Appendix 22 of the Applicant's Deadline 2 Submission). Further comment on the relevance of that document is provided following the in-combination assessment.

12.3.24 The determination of AEoI for plans and projects in-combination with Thanet Extension in relation to harbour porpoise is determined below.

The Species potential to remain a Viable Component of the Site

12.3.25 For the purposes of the assessment of AEoI in-combination for harbour porpoise, the methodology applied to the assessment alone for the Conservation Objectives concerned with viability (in relation to potential for injury or mortality), has been extended to consider the potential for effect from the above projects in-combination.

12.3.26 As noted above, just one site has been screened in for assessment in relation to harbour porpoise – the SNS cSAC/SCI. The assessment presented here therefore relates to the SNS cSAC/SCI only.

12.3.27 It has been concluded for Thanet Extension alone that, whilst activities are taking place with associated levels of underwater noise which, if un-controlled, could result in the risk of injurious or even lethal effects on harbour porpoise, given the existing protected nature of these species, embedded mitigation and project commitments (as controlled through the MMMP), the risk of such injurious or lethal effects is appropriately managed. As a result of these existing controls, the type, scale and extent of potential impacts arising from Thanet Extension (and indeed other licenced projects and activities) means that there is no AEoI for harbour porpoise viability (in relation to injury or mortality effects) as a result of the construction, operation and decommissioning of Thanet Extension. The potential for impact is such that it can similarly be concluded (and confirmed within the Screening Matrix (Annex 2, Application Ref 5.2.2), taking account of the similar controls on all licenced projects and or activities that may result in underwater noise sufficient to result in injurious and or lethal effects on harbour porpoise) that no pathway exists for a contribution to AEoI in-combination from Thanet Extension. The same logic applies to all other projects identified within Table 8.2.

12.3.28 There is, therefore, no AEoI to the viability of harbour porpoise in relation to mortality or injury effects from Thanet Extension in-combination and therefore, subject to natural change, harbour porpoise will be maintained as a 'viable component' of the SNS cSAC/SCI in the long-term with respect to the potential for mortality and injury.

12.3.29 The remaining potential for adverse effect on the viability of harbour porpoise within the SNS cSAC/SCI therefore relates solely to significant disturbance as a result of underwater noise. Full consideration of the potential for a significant disturbance to result from the project in-combination, sufficient to lead to AEoI, is provided below.

Potential for Significant Disturbance to the Species within the Site

12.3.30 For the purposes of the assessment of AEoI in-combination for harbour porpoise, the methodology applied to the assessment alone for the Conservation Objectives concerned with significant disturbance in harbour porpoise has been extended to consider the potential for effect from the above projects in-combination.

12.3.31 The overall aim of the assessment of disturbance within the SNS cSAC/SCI is to identify the percentage of the relevant part of the cSAC within which harbour porpoise may exhibit avoidance behaviour (displacement) together with an understanding of the total duration of disturbance, within the overall construction window. The approach takes account of both spatial and temporal elements, as required by the definition of significance. As the overall construction window falls at least partially within more than one season, the assessment is presented on a seasonal basis – to enable the potential for effect to be fully understood.

12.3.32 The following assessment includes a number of assumptions, with these summarised as follows:

- Only relevant works planned for the period 1st October 2018 - 31st March 2023 (i.e. the winter seasons that fall across the period within which project related construction works at Thanet Extension may result in underwater noise) to be included;
- An assumption that all UXO clearance, geophysical survey and foundation piles at Thanet Extension will be installed within this timeframe;
- Should geophysical survey occur, a 10 km buffer has been applied around the array boundary; and
- The maximum spatial overlap that may occur from an individual UXO clearance or piling location within each project has been assumed (based on a 26 km EDR).

12.3.33 Table 12.4 summarises the potential for effect from a single event (whether that be piling or UXO clearance) per day. The potential effect from piling at more than one foundation location, or more than one UXO clearance, to occur per 24 hours is summarised in Table 12.5. Values are presented as minimum and maximum (where relevant) as the location of noise relevant to the SNS cSAC/SCI will affect the degree of spatial overlap.

Table 12.4: Spatial effect in-combination from a single event in a single day per season[91]

Project	Spatial Effect from a single event within the relevant season in a 24 Hour Period										Relevant Activity
	Winter Season (2018-2019)		Winter Season (2019 - 2020)		Winter Season (2020 - 2021)		Winter Season (2021-2022)		Winter Season (2022 - 2023)		
	km²	%	km²	%	km²	%	km²	%	km²	%	
Thanet Extension (geophysical survey)	370	2.91	370	2.91	370	2.91	X	X	X	X	Unknown timeframe for geophysical survey (if required), but likely to commence prior to UXO clearance
Thanet Extension (UXO)	1,308 (max) 581 (min)	10.31 (max) 4.58 (min)	1,308 (max) 581 (min)	10.31 (max) 4.58 (min)	1,308 (max) 581 (min)	10.31 (max) 4.58 (min)	X	X	X	X	Unknown timeframe for UXO clearance (if required), but likely to commence six months prior to piling.
Thanet Extension (piling)	X	X	X	X	1,308 (max) 581 (min)	10.31 (max) 4.58 (min)	1,308 (max) 581 (min)	10.31 (max) 4.58 (min)	1,308 (max) 581 (min)	10.31 (max) 4.58 (min)	Construction piling. Offshore construction to start 2021
Tier 1											
Borssele 1, 2, 3, 4 & 5			95	0.75	95	0.75					Foundation piling within 2020
East Anglia ONE	2,486 OR 2,008	20 OR 16	X	X	X	X	X	X	X	X	Piling and UXO extended to end September 2019 Note – licensed for up to 2 activities per 24 hours (whether that activity is UXO and/or piling) – the numbers given are for 2 activities followed by a single activity per day
Triton Knoll	0	0	X	X	X	X	X	X	X	X	Seismic survey (currently uncertain requirement for, timing and duration but would precede the piling)
Triton Knoll	46	0.17	X	X	X	X	X	X	X	X	UXO clearance (currently uncertain requirement for, timing and duration but would precede the piling)

[91] Note that for Thanet Extension, only piling OR UXO clearance OR geophysical survey can occur in a single 24 hour period – therefore as a worst-case where more than one activity could occur that season, the maximum level for a single activity at Thanet Extension is assumed

Project		Spatial Effect from a single event within the relevant season in a 24 Hour Period										Relevant Activity
		Winter Season (2018-2019)		Winter Season (2019 - 2020)		Winter Season (2020 - 2021)		Winter Season (2021-2022)		Winter Season (2022 - 2023)		
		km²	%	km²	%	km²	%	km²	%	km²	%	
Triton Knoll		9	0.07	9	0.07	X	X	X	X	X	X	Piling to occur at some point within the construction window of 2017 to 2021; anticipated to be complete by the end of the summer season 2020
Hornsea Project One (piling)		0	0	X	X	X	X	X	X	X	X	Piling and UXO licensed through at least part of the summer season 2019
Hornsea Project One (UXO)		0	0	X	X	X	X	X	X	X	X	
Hornsea Project Two		0	0	0	0	0	0	X	X	X	X	Piling programmed Q1 2018 - Q3 2021
Maximum total for Tier 1 plus Thanet Extension		**3,849**	**30.55%**	**1,412**	**11.13**	**1,403**	**11.06**	**1,308**	**10.31**	**1,308**	**10.31**	Note that the impact areas presented are where only either piling or UXO clearance occurs within any 24 hour period.
Minimum total for Tier 1 plus Thanet Extension		**2,424**	**19.15**	**474**	**3.73**	**465**	**3.66**	**581**	**4.579**	**581**	**4.579**	
Tier 2												
Dogger Bank Creyke Beck	A	X	X	X	X	0	0	0	0	0	0	Consent issued but no CFD. Construction window 2021-2024
	B	X	X	X	X	0	0	0	0	0	0	
Dogger Bank Teesside A		X	X	0	0	0	0	0	0	0	0	Consent issued but no CFD. Construction window 2020 onwards for 6 years
Sofia		X	X	0	0	0	0	0	0	0	0	Consent issued but no CFD. Construction window 2020-2025
East Anglia THREE		X	X	1,827 (max 288 (min))	14.40 (max) 2.27 (min)	1,827 (max 288 (min))	14.40 (max) 2.27 (min)	1,827 (max 288 (min))	14.40 (max) 2.27 (min)	1,827 (max 288 (min))	14.40 (max) 2.27 (min)	Consent issued but no CFD. Offshore construction would begin in 2020 at the earliest
Maximum total for Tier 2 plus Tier 1 plus Thanet Extension		3,849	30.55	3,239	25.53	3,230	25.46	3,135	24.71	3,135	24.71	Note that the impact areas presented are where only either piling or UXO clearance occurs at Thanet Extension within any 24 hour period.
Minimum total for Tier 2 plus Tier 1 plus Thanet Extension		2,424	19.15	762	6	753	5.93	869	6.849	869	6.849	

Project	Spatial Effect from a single event within the relevant season in a 24 Hour Period										Relevant Activity
	Winter Season (2018-2019)		Winter Season (2019 - 2020)		Winter Season (2020 - 2021)		Winter Season (2021-2022)		Winter Season (2022 - 2023)		
	km²	%	km²	%	km²	%	km²	%	km²	%	
Tier 3 (											
Hornsea Project THREE	X	X	X	X							Piling 2022-2023 and 2029-2030
Tier 4 (None identified)											

Table 12.5: Spatial effect in-combination from multiple events in a single day per season[92]

Project	Spatial Effect from multiple events within the relevant season in a 24 Hour Period										Relevant Activity
	Winter Season (2018-2019)		Winter Season (2019 - 2020)		Winter Season (2020 - 2021)		Winter Season (2021-2022)		Winter Season (2022 - 2023)		
	km²	%	km²	%	km²	%	km²	%	km²	%	
Thanet Extension (geophysical survey)	370	2.91	370	2.91	370	2.91	X	X	X	X	Unknown timeframe for geophysical survey (if required), but likely to commence prior to UXO clearance
Thanet Extension (UXO)	1,503 (max) 581 (min)	11.84 (max) 4.579 (min)	1,503 (max) 581 (min)	11.84 (max) 4.579 (min)	1,503 (max) 581 (min)	11.84 (max) 4.579 (min)	X	X	X	X	Unknown timeframe for UXO clearance (if required), but likely to commence six months prior to piling.
Thanet Extension (piling)	X	X	X	X	1,485 (max) 581 (min)	11.71 (max) 4.579 (min)	1,485 (max) 581 (min)	11.71 (max) 4.579 (min)	1,485 (max) 581 (min)	11.71 (max) 4.579 (min)	Construction piling. Offshore construction to start 2021
Tier 1											
Borssele 1, 2, 3, 4 & 5			95	0.75	95	0.75					Foundation piling within 2020
East Anglia ONE	2,486 OR 2,008	20 OR 16	X	X	X	X	X	X	X	X	Piling and UXO extended to end September 2019 Note – licensed for up to 2 activities per 24 hours (whether that activity is UXO and/or piling) – the numbers given are for 2 activities followed by a single activity per day
Triton Knoll	0	0	X	X	X	X	X	X	X	X	Seismic survey (currently uncertain requirement for, timing and duration but would precede the piling)
Triton Knoll	46	0.17	X	X	X	X	X	X	X	X	UXO clearance (currently uncertain requirement for, timing and duration but would precede the piling)

[92] Note that for Thanet Extension, only piling OR UXO clearance OR geophysical survey can occur in a single 24 hour period – therefore as a worst-case where more than one activity could occur that season, the maximum level for a single activity at Thanet Extension is assumed

Project		Spatial Effect from multiple events within the relevant season in a 24 Hour Period										Relevant Activity
		Winter Season (2018-2019)		Winter Season (2019 - 2020)		Winter Season (2020 - 2021)		Winter Season (2021-2022)		Winter Season (2022 - 2023)		
		km²	%	km²	%	km²	%	km²	%	km²	%	
Triton Knoll		9	0.07	9	0.07	X	X	X	X	X	X	Piling to occur at some point within the construction window of 2017 to 2021; anticipated to be complete by the end of the summer season 2020
Hornsea Project One (piling)		0	0	X	X	X	X	X	X	X	X	Piling and UXO licensed through at least part of the summer season 2019
Hornsea Project One (UXO)		0	0	X	X	X	X	X	X	X	X	
Hornsea Project Two		0	0	0	0	0	0	X	X	X	X	Piling programmed Q1 2018 - Q3 2021
Maximum total for Tier 1 plus Thanet Extension		**4,414**	**34.99**	**1,882**	**15.57**	**1,968**	**15.5**	**1,485**	**11.71**	**1,485**	**11.71**	Note that the impact areas presented are where only either piling or UXO clearance occurs at Thanet Extension within any 24 hour period.
Minimum total for Tier 1 plus Thanet Extension		**3,014**	**23.73**	**1,055**	**8.31**	**1,046**	**8.24**	**581**	**4.58**	**581**	**4.58**	
Tier 2												
Dogger Bank Creyke Beck	A	X	X	X	X	0	0	0	0	0	0	Consent issued but no CFD. Construction window 2021-2024
	B	X	X	X	X	0	0	0	0	0	0	
Dogger Bank Teesside A		X	X	0	0	0	0	0	0	0	0	Consent issued but no CFD. Construction window 2020 onwards for 6 years
Sofia		X	X	0	0	0	0	0	0	0	0	Consent issued but no CFD. Construction window 2020-2025
East Anglia THREE		X	X	1,880 (max) 288 (min)	14.82 (max) 2.27 (min)	1,880 (max) 288 (min)	14.82 (max) 2.27 (min)	1,880 (max) 288 (min)	14.82 (max) 2.27 (min)	1,880 (max) 288 (min)	14.82 (max) 2.27 (min)	Consent issued but no CFD. Offshore construction would begin in 2020 at the earliest
Maximum total for Tier 2 plus Tier 1 plus Thanet Extension		**4,414**	**34.99**	**3,762**	**30.39**	**3,85**	**30.32**	**3,365**	**26.53**	**3,365**	**26.53**	

Project	Spatial Effect from multiple events within the relevant season in a 24 Hour Period										Relevant Activity
	Winter Season (2018-2019)		Winter Season (2019 - 2020)		Winter Season (2020 - 2021)		Winter Season (2021-2022)		Winter Season (2022 - 2023)		
	km²	%	km²	%	km²	%	km²	%	km²	%	
Minimum total for Tier 2 plus Tier 1 plus Thanet Extension	**3,014**	**23.73**	**1,343**	**10.58**	**1,334**	**10.51**	**869**	**6.85**	**869**	**6.85**	Note that the impact areas presented are where only either piling or UXO clearance occurs at Thanet Extension within any 24 hour period.
Tier 3											
Hornsea Project THREE	X	X	X	X	X	X	0	0	0	0	Piling 2022-2023 and 2029-2030
Tier 4 (None identified)											

12.3.34 Table 12.4 identifies the minimum and maximum combined spatial overlap for Tier 1 projects within all winter seasons within which underwater noise during construction may occur at Thanet Extension, assuming that piling is limited to a maximum of a single foundation location per day, with UXO clearance limited to a maximum of a single event per day. Further, it assumes that all activity at Thanet Extension is limited to one per day – i.e. only piling OR UXO clearance OR geophysical survey may occur per day. Additional values are given for Tier 2 and Tier 3 projects for completeness. These values should be viewed in the context of the project uncertainties highlighted above in paragraph 1.1.17 *inter alia*.

12.3.35 For Thanet Extension in-combination with all Tier 1 projects on any given day from the start of the winter season 2019/2020 (as the contribution from Thanet Extension is only applicable during the winter season) is up to 11.13%, and therefore remains below the 20% threshold. Although Hornsea Projects One and Two both fall within Tier 1, their location is such that they are more than 26km from the winter extents of the SNS cSAC/SCI and their contribution during the winter season is therefore zero. The exception to this is during the winter season 2018/2019, which we are currently more than half way through at the time of writing (February 2019). The risk here relates to works at East Anglia ONE and the potential for geophysical survey or UXO clearance to be required at Thanet Extension in the same day as works at East Anglia ONE. Such an incident is considered extremely unlikely (notably because of the lead in time required for UXO clearance with insufficient time remaining for such works to occur at Thanet Extension prior to April 2019 and the lack of project planned geophysical surveys), however certainty is provided within the SIP (Appendix 22 of the Applicant's Deadline 2 Submission), which provides for such a scenario and includes management measures to ensure that, should such a scenario occur, the thresholds would not be exceeded.

12.3.36 Further, consideration of Tier 2 projects is also provided. Here, the risk is represented by East Anglia Three, should that project achieve CfD and progress to construction within the relevant timeframe. Although the likelihood of such an occurrence is considered extremely low, certainty is again provided for such an eventuality through the SIP (Appendix 22 of the Applicant's Deadline 2 Submission), to ensure management measures are implemented in such a scenario and ensure the thresholds would not be exceeded.

12.3.37 As demonstrated in Table 12.5, should piling occur at more than one foundation location in a 24 hour period, or UXO clearances be undertaken in locations resulting in the maximum spatial extent of effect on a single day, the 20% threshold will similarly not be exceeded with the exception of a risk of exceedance during winter season 2018/2019. The maximum that could occur during a winter season post 2018/2019 would again be during the winter season 2019 - 2020, being up to 12.66% in a single day. As above, the risks posed by East Anglia ONE (for the winter season 2018/2019) and by East Anglia THREE (should the project achieve CfD and progress to construction within the relevant timeframe) is addressed through the measures provided in the SIP (Appendix 22 of the Applicant's Deadline 2 Submission), should such a scenario occur.

12.3.38 As a consequence, and in light of the certainty offered by the SIP, which is provided for within the draft Generation Assets dML (condition 12(k) of generation assets dML, 10(l) of export cable systems dML), it is concluded that, with appropriate mitigation as required and defined within the SIP, an AEoI will not occur as a result of disturbance to harbour porpoise (as defined by the daily 20% threshold) in-combination with other Tier 1 projects or all Tier 2 projects during all relevant winter seasons, within which geophysical survey, UXO clearance and piling activity may take place at Thanet Extension.

In-combination effects on disturbance across a season

12.3.39 As regards the consideration of the potential for an in-combination effect across a season (the 10% value), as for the assessment of the project alone a number of highly precautionary assumptions have been made (following the precedent set by the determination for the project alone in section 11.3). These are based on three scenarios:

- Scenario 1: Thanet Extension plus Tier 1 projects in winter season 2018/2019 – excluding piling at Thanet Extension (piling will not commence in that timeframe) and works at Triton Knoll (which has yet to commence works as of December 2018) and Borssele (which will not be undertaking piling in 2020);
- Scenario 2 – Thanet Extension plus Tier 1 projects in winter seasons after 2018/2019 (and therefore excluding East Anglia ONE); and
- Scenario 3 – Thanet Extension plus Tier 1 projects and Tier 2 projects in winter seasons after 2018/2019 (and therefore excluding East Anglia ONE but including East Anglia THREE).

12.3.40 The values included per project are summarised below, as these are incorporated into the different scenarios:

- Piling at Thanet Extension assumed to occur at 36 foundation locations wholly within a single six month winter season (excluding season 2018/2019), assuming (as the worst-case) foundations to be installed individually (i.e. only one foundation per day, requiring 36 days in total), with a maximum spatial effect per day of 10.31%;
- Up to 30 UXO clearances at Thanet Extension on 30 separate days wholly within a single six month winter season, each resulting in a maximum spatial area of effect of 10.31%;
- Geophysical survey at Thanet Extension, with an assumed 10 km buffer and therefore maximum spatial extent of effect of 2.91%, lasting ten days wholly within a single six month winter season;
- Borssele – assuming that piling would occur each day of a single winter season, each event resulting in the maximum potential spatial effect;

- East Anglia ONE – of the 102 WTGs, some 34 were installed prior to the winter season 2018/2019, with 68 remaining. Therefore assumes that piling would occur on 68 days of winter season 2018/2019, each event resulting in the maximum potential spatial effect;
- Triton Knoll – assuming that piling would occur each day of a single winter season, each event resulting in the maximum potential spatial effect; and
- East Anglia THREE – assuming that piling would occur each day of a single winter season, each event resulting in the average potential spatial effect (calculated as the mean of the minimum and maximum values).

12.3.41 The Tier 1 projects Hornsea Project One and Hornsea Project Two screened in for in-combination assessment would result in spatial effect within the summer seasonal extents of the SNS cSAC/SCI only and therefore would not result in an in-combination effect with works at Thanet Extension.

12.3.42 Following the three scenarios outlined above, the potential for effect when averaged across a season under scenario 1 is up to 9.3% and under scenario 2 is up to 4.7%, both therefore well below the 10% threshold. Under scenario 3, under the worst case assumptions applied above (including piling every day at Borssele, Triton Knoll and East Anglia THREE together with installation of all foundations at Thanet Extension, clearance of all UXO at Thanet Extension and geophysical survey at Thanet Extension), there is a risk of the seasonal average reaching 13.3%, which would exceed the 10% seasonal threshold. The risk sould be considered in the following context:

- Piling at Borssele will occur in 2020, with piling at Thanet Extension in 2021 onwards (therefore minimising the risk of overlap);
- East Anglia THREE is a Tier 2 project and therefore there is very low certainty about the project; and
- Such a rate of construction exceeds that feasible for all of the in-combination projects, for example no project installs piles every day (requiring time for transit, weather etc).

12.3.43 To provide certainty in the conclusion presented here, and in the context of the risk represented by scenario 3, the SIP (Annex C to Appendix 1 of the Applicant's Deadline 1 Submission (PINS Ref REP1-023)) provides for management measures to ensure that should Tier 2 projects come forward within the same timeframe as relevant construction at Thanet Extension, that measures are in place to ensure that the thresholds will not be exceeded.

Potential for AEoI from disturbance in-combination

12.3.44 It is clear from the information above that provided the requirements of the SIP are adhered to, neither the 20% value within a 24 hour period nor the 10% threshold of significance across a season will be exceeded by Thanet Extension in-combination with other Tier 1 or Tier 2 projects, for any of the relevant winter seasons considered. There is, therefore, no AEoI on harbour porpoise in relation to significant disturbance from Thanet Extension in-combination and, therefore, subject to natural change, in the long-term, there will be no significant disturbance of harbour porpoise. The key points addressed within the SIP are summarised as follows:

- During the winter season 2018/2019 – should geophysical survey and UXO clearance be required at Thanet Extension in this timeframe, the SIP includes measures to ensure the daily 20% threshold is not exceeded in-combination with East Anglia ONE; and

Should the Tier 2 project East Anglia THREE achieve CfD and progress to construction within the same timeframe as Thanet Extension, the SIP includes measures to ensure the daily 20% and seasonal 10% thresholds are not exceeded in-combination.The Supporting Habitats and Processes Relevant to Harbour Porpoise and their Prey are Maintained

12.3.45 For the purposes of the assessment of AEoI in-combination for harbour porpoise, the methodology applied to the assessment alone for the Conservation Objectives concerned with the supporting habitats of harbour porpoise and their prey, has been extended to consider the potential for effect from the above projects in-combination.

12.3.46 It has been concluded alone and in-combination that there is a lack of pathway linking underwater noise to the habitat characteristics of the seabed and water column, with potential impacts identified on fish receptors being localised, short-term and reversible with harbour porpoise able to exploit similar resources in adjacent undisturbed areas. It can therefore be concluded (and confirmed within the Screening Matrix in Annex 2 (Application Ref 5.2.2) that there is no potential for LSE for harbour porpoise prey as a result of the construction, operation and decommissioning of Thanet Extension in-combination. The conclusion is supported by Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7) which, in its cumulative assessment for fish ecology, concluded the potential for effect to be not significant at most.

12.3.47 There is, therefore, no AEoI to the supporting habitat and processes relevant to harbour porpoise and their prey from Thanet Extension in-combination and therefore, subject to natural change, the availability and density of suitable harbour porpoise prey will be maintained in the long-term.

Potential for an In-combination Effect on Harbour Seal and Grey Seal from Underwater Noise

12.3.48 Table 12.6 below provides further information on the potential for temporal in-combination effects in relation to the above plans and projects screened in for assessment in relation to harbour seal and grey seal only. It should be noted that the location of the projects screened in is such that each project is relevant to a different suite of transboundary sites.

Table 12.6:Temporal overlap with Thanet Extension of plans and projects considered in-combination (harbour seal and grey seal)

Project	Construction window					Relevant Activity
	2019	2020	2021	2022	2023	
Thanet Extension						Seismic survey (currently uncertain requirement for, timing and duration but would precede the piling and UXO clearance) to be undertaken 2019 at the earliest (but 2020 being more likely)
Thanet Extension						UXO clearance (currently uncertain requirement for, timing and duration but would precede the piling, likely to be within 6 months of piling) to be undertaken 2019 at the earliest (but 2020 being more likely)
Thanet Extension						Construction piling. Offshore construction to start in 2021
Tier 1 (*Grey shading represents the construction window within which the activity may occur*)						
Borssele 1 & 2, 3 & 4, 5						Foundation piling window 2020
East Anglia ONE						Piling and UXO extended to end September 2019
Tier 2 (*Grey shading represents the construction window within which the activity may occur*)						
East Anglia THREE						Consent issued but no CfD. Offshore construction would begin in 2020 at the earliest
Tier 3 (None identified)						
Tier 4 (None identified)						

12.3.49 The potential for the Tier 2 wind farms to have a construction window that would overlap with Thanet Extension has been discussed above. Further, works at East Anglia ONE will not overlap with works at Borssele or at East Anglia THREE. The worst case for an in-combination effect from Thanet Extension on the sites screened in for grey seal and harbour seal would therefore relate to one of the following combinations:

- During works at East Anglia ONE and Thanet Extension (limited potential for a temporal overlap until the end of March 2019);
- During works at Borssele and Thanet Extension (would occur during 2020 only and would at most relate to UXO and geophysical survey only at Thanet Extension, with piling periods not overlapping between the projects); and
- During works at East Anglia THREE and Thanet Extension.

12.3.50 The potential for an in-combination effect also varies between the transboundary sites screened in for LSE for seals, with some sites lying outside the range of effect, as summarised in .

Table 12.7: Summary of Transboundary Sites Designated for Harbour Seals and Grey Seals Screened in for Assessment In-Combination

	Sites screened in for grey seals and harbour seals						Sites screened in for grey seals only		
Projects	**Bancs des Flandres**	**Recifs Gris-Nez Blanc-Nez**	**Vlakte van de Raan**	**Vlaamse Banken**	**Voordelta**	**Ridens et dunes hydrauliques du détroit du**	**SBZ1**	**SBZ2**	**SBZ3**
East Anglia ONE and Thanet Extension	Screened in for grey seal and harbour seal					Screened out based on range to East Anglia ONE	Screened in for grey seal only		
Borssele and Thanet Extension	Screened in for grey seal and harbour seal					Screened in for grey seal only			
East Anglia THREE and Thanet Extension	Screened in for grey seal only	Screened out based on range to East Anglia THREE	Screened in for grey seal only	Screened in for grey seal and harbour seal		Screened out based on range to East Anglia THREE	Screened in for grey seal only		

12.3.51 As for the determination of the potential for AEoI in harbour seals and grey seals for the project alone, the assessment in-combination is being made against the measures for FCS, as follows:

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

12.3.52 Key to the determination of the potential for an AEoI in-combination, with respect to harbour seal and grey seal, are the following points:

- There is limited potential remaining for works at Thanet Extension to occur in the winter period 2018/2019 and therefore in-combination with works at East Anglia ONE. In particular, it is highly unlikely that any UXO works could occur within the remaining part of that season, given the timeframe attached to achieving necessary licenses;
- Borssele is situated off the Dutch coast, approximately 90 – 100 km from Thanet Extension and it is therefore extremely unlikely that any project level effects associated with each project would overlap. Further, the timeframe for construction works at Borssele is limited (2020), and there is no certainty regarding if those works would have temporal overlap with works at Thanet Extension;
- As noted above, there is strong uncertainty regarding East Anglia THREE, a tier 2 project, and therefore no certainty that any in-combination effect will occur with Thanet Extension;
- The potential for effect from Thanet Extension alone in relation to harbour seals and grey seals is highly limited in terms of the percentage of the overall population of harbour seal and grey seal that may be affected on a temporary and intermittent basis;
- For all projects, if deemed necessary by the project consents, project specific mitigation is anticipated to be required to address issues around species viability (although no certainty can be provided regarding mitigation requirements likely to be implemented in countries other than the UK) and therefore no adverse effect on the viability of harbour seal and grey seal populations are anticipated from Thanet Extension in-combination;
- The short-term and intermittent nature of the underwater noise generated during construction, combined with the limited potential for temporal overlap between Thanet Extension and the three projects considered in-combination, combines to ensure that the natural range of harbour seal and grey seal would not be affected by underwater noise from Thanet Extension in-combination in the long-term; and
- The short-term and temporary nature of such effects mean that the available habitat for harbour seal and grey seal will not be affected in the long-term by underwater noise associated with Thanet Extension in-combination.

12.3.53 There is, therefore, no AEoI to the harbour seal and grey seal feature of the transboundary sites in relation to underwater noise during construction from Thanet Extension in-combination with other plans or projects and therefore, subject to natural change, the conservation status of harbour seal and grey seal features will not be affected in the long-term with respect to the potential for underwater noise during construction.

Operations and Maintenance

Accidental Pollution

12.3.54 The potential for an AEoI in-combination as a result of accidental pollution on marine mammals during operation and maintenance relates to the following designated sites and the relevant features (i.e. those features screened in for LSE).

- Southern North Sea cSAC/SCI (harbour porpoise); and
- Bancs des Flandres SCI (harbour porpoise, harbour seal and grey seal).

12.3.55 The potential for accidental pollution to affect marine mammals was not considered in the ES (Volume 2, Chapter 7: Marine Mammals (Application Ref 6.2.7), given the inclusion of the following in the project specific mitigation table (Table 7.15):

'A Project Environmental Management Plan (PEMP) will be produced and followed to cover the construction and O&M phases. This will also incorporate plans to cover accidental spills, potential contaminant release and include key emergency contact details (e.g. MMO, Maritime and Coastguard Agency (MCA) and the project site co-ordinator). A decommissioning programme will be developed to cover the decommissioning phase. The purpose of the measures to be implemented ensure that potential for contaminant release is strictly controlled and therefore provides protection to marine life across all phases of the life of the project.'

12.3.56 The implementation of the PEMP, produced in consultation with Natural England and provided for in the DCO as part of the standard dML requirements, enabled the conclusion in section 11, for the project alone, that there is, therefore, no AEoI to the marine mammals in relation to accidental pollution from Thanet Extension. An equivalent requirement to address the risk of accidental pollution is a standard aspect of all offshore wind farm projects. It can therefore be concluded that the requirement for such plans for all relevant projects results in a conclusion for the project in-combination of, subject to natural change, no AEoI and that the marine mammal features will be maintained in the long term with respect to the potential for accidental pollution.

12.4 Offshore Ornithology

12.4.1 A description of the significance of in-combination effects upon the receptors grouped under 'offshore ornithology' is provided below.

Construction and Decommissioning

Offshore cables direct disturbance and displacement

12.4.2 The potential for offshore cables direct disturbance and displacement to result in an AEoI in-combination with Thanet Extension relates to the following designated sites and the relevant features:

- Outer Thames Estuary SPA; red-throated diver.

12.4.3 The plans and projects identified with the potential to contribute to an in-combination effect are as follows:

- Nemo Link.

12.4.4 The potential impact of Thanet Extension arising from direct disturbance and displacement during the construction phase (including cable laying) has been considered alone above. Any direct disturbance and displacement in the construction phase will be short-term (temporary) and it is this type of potential impact that has been screened in for in-combination impact assessment together with other offshore cable laying operations on red-throated diver that is the interest feature of the Outer Thames Estuary SPA.

12.4.5 A single cable laying operation has been identified and screened in for the in-combination assessment – Nemo Link. The cable laying operation for this project is currently in progress (2017/18) and is expected to have been completed before Thanet Extension might be under construction.

12.4.6 For a quantitative assessment of the in-combination impacts it requires this project to have published predicted numbers on birds that would be displaced during its construction phase.

12.4.7 The Nemo Link interconnector has been granted consent, with construction underway. The successful application was accompanied by an ES that included a volume on the marine environment (PMSS, 2013) and a chapter on the biological environment that assessed impacts on birds (section 7.2), including offshore birds. The assessment concluded with respect to offshore birds that it "is not likely that the proposed cable installation will have a substantially greater impact on these bird species than the existing shipping already present in this area" (section 7.2.3.1) and did not carry out any quantitative assessment of impacts.

12.4.8 In the absence of quantitative information on the Nemo Link interconnector, a qualitative approach to assessment is necessary. Both projects have been assessed – Nemo Link and Thanet Extension – and neither has been assessed as having a significant impact alone with respect to cable laying (although the construction operations alone that relate to Thanet Extension array installation have been screened in for LSE in this RIAA). Accordingly, it is considered highly unlikely that these two projects, even if they were to be implemented at the same time or in close succession, will act in-combination.

12.4.9 The Nemo Link interconnector completed construction in 2018 and is undertaking commissioning during December 2018 and January 2019. Thanet Extension array installation and export cable laying are planned, subject to consent, for early in 2021. These project timelines mean that cable laying for Nemo Link will not occur in the same year as Thanet Extension construction, removing such a potential type of in-combination impact. The potential for the successive cable laying operations that occur through sub-tidal waters in to Pegwell Bay in 2017/18 and 2021 to have a significant in-combination impact is also considered unlikely given that they are each of short duration and take place in waters that do not support significant populations of red-throated diver (both cable laying operations avoid the Outer Thames Estuary SPA). It is concluded that the in-combination impact of cable laying operations and Thanet extension construction on red-throated diver will not occur.

12.4.10 There is, therefore, no potential for AEoI to the red-throated diver feature of the Outer Thames Estuary SPA in relation to in-combination disturbance and displacement effects and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term with respect to the potential for adverse effects from in-combination disturbance and displacement.

Operations and Maintenance

Offshore wind farms direct disturbance and displacement

12.4.11 The potential for offshore wind farms direct disturbance and displacement to result in an AEoI in-combination with Thanet Extension relates to the following designated sites and the relevant features:

- Outer Thames Estuary SPA; red-throated diver.

12.4.12 An in-combination impact on red-throated diver, which is an interest feature of the Outer Thames Estuary SPA, resulting from Thanet Extension in-combination with other OWFs was screened in for LSE in the Thanet Extension HRA Screening Report (Annex 1 to this report). The HRA Screening Report did not contain a quantitative in-combination assessment.

12.4.13 The PEIR Offshore Ornithology chapter (PEIR Volume 2, Chapter 4) did contain a quantitative cumulative assessment of the potential effects of disturbance and displacement on red-throated diver in the UK waters of the North Sea. That cumulative assessment was carried out using published guidance and SNCB advice (JNCC & NE, 2013; King et al., 2009; RenewableUK, 2013; PINS, 2012 and 2015) and followed the practice of ESs submitted by other OWF developers. The methodology applied in that cumulative assessment and the resulting outcomes were discussed with stakeholders in the Evidence Plan meetings held on 2nd October 2017 in relation to the RIAA and on 4th October 2017 in relation to the offshore environment (Evidence Plan Report Doc. Ref, 8.5). After publication of the PEIR, but prior to the deadline for responses to be submitted, a conference call was held with Natural England and the RSPB on 12th December 2017. Attendees from Natural England and the RSPB were provided with a briefing paper about the issues arising from the method by which the cumulative assessment had been carried out and why, as a result, firm reliance could not be placed on its results. Those issues included:

- Some ESs did not assess red-throated diver displacement at all;
- Some ESs did not assess red-throated diver displacement in a quantitative fashion;
- Some ESs applied a buffer that was significantly less than current recommended practice; and
- A number of the OWFs have been built out at a scale that is less then that which was assessed as the worst-case in the ES.

12.4.14 A possible resolution of these issues was proposed using a new approach for both the cumulative assessment to inform the EIA and the in-combination assessment to inform the RIAA, aimed at considering Thanet Extension in context relative to other plans and projects. That new approach was to standardise the sources of information, parameters and analysis rather than adopt the different approaches used in different ESs. This standardised approach to the in-combination assessment was supported in principle by Natural England and the RSPB.

12.4.15 The method applied in that standardised approach and the in-combination predicted impacts expressed as numbers of red-throated divers, rather than percentages, are described in detail in a report submitted to the Examination at Deadline 1 in the form of a Written Representation/ Clarification Note on red-throated diver cumulative (EIA) and in-combination (HRA) impact assessment methodology (Annex C to Appendix 1 of the Applicant's Deadline 1 Submission (PINS Ref REP1-023)). Set out below is a summary of those findings applicable to the HRA and the assessment in terms of whether or not there is a conclusion of no AEoI.

12.4.16 The standardisation in the method for the in-combination assessment that is presented below included:

- Placing the 'alone' contribution of Thanet Extension in context, relative to all other proposed, consented or constructed offshore wind farms, mitigating the false confidence that can arise when considering absolute numbers derived from uncertain sources;
- Applying a single source of red-throated diver density across all the offshore wind farms included in the assessment, this being the density that was modelled for the Seabird Mapping and Sensitivity Tool (SeaMaST) dataset (Bradbury et al., 2014), a copy of which was supplied by Natural England;
- Using GIS to overlay development boundaries on to the red-throated diver density model with those boundaries, where relevant, being the as-built layout of the array or the DCO/dML consented array layout, rather than the worst-case design for the array as assessed in the application and published in the ES;
- Considering the two ends of the range of scenarios over which standardised displacement matrices are prepared, that is a) complete displacement within the OWF and none outside it, and b) complete displacement within the OWF accompanied by complete displacement for a distance of 4 km outside it; and
- Apportioning a percentage of birds to the Outer Thames Estuary SPA where the wind farm is located outside the SPA but functionally linked to it due to its proximity on the basis of the ratio of the population of the SPA (6,466 individuals) to the population of the wider area that was examined in the process of determining the boundary of the SPA (8,132 individuals from O'Brien et al., 2012) where this ratio is 0.795.

12.4.17 Those OWFs screened in for consideration were identified based on geographic proximity. Those OWFs were a) those within the boundary of the Outer Thames Estuary SPA (being the extended SPA boundary, classified in October 2017); and b) those for which the Outer Thames Estuary SPA was the nearest SPA or pSPA with red-throated diver as an interest feature. Those OWFs screened in are listed in Table 12.8, ordered by Tier. Those OWFs further to the north have been attributed to the Greater Wash SPA, as it is geographically closer, and they do not form part of this in-combination assessment.

Table 12.8: OWFs whose potential displacement effects were attributed to the Outer Thames Estuary SPA

Offshore wind farm	Tier	Location relative to the SPA
Gunfleet Sands	1	Within the OTE SPA
Kentish Flats	1	Within the OTE SPA
Kentish Flats Extension	1	Within the OTE SPA
London Array	1	Within the OTE SPA
Scroby Sands	1	Within the OTE SPA (part)
Galloper	1	Outside of, but functionally linked to OTE SPA
Greater Gabbard	1	Outside of, but functionally linked to OTE SPA
Thanet	1	Outside of, but functionally linked to OTE SPA
East Anglia ONE	2	Outside of, but functionally linked to OTE SPA
East Anglia THREE	3	Outside of, but functionally linked to OTE SPA
Norfolk Vanguard East & West	4	Outside of, but functionally linked to OTE SPA
Thanet Extension	4	Outside of, but functionally linked to OTE SPA

12.4.18 In the process of adding up relative contributions from each OWF, account had to be taken of the fact that when considering adjacent, nearby or extended OWFs there was a possibility that they were being developed within the 4 km buffer of a preceding OWF or that the 4 km buffer of the more recently proposed OWF overlapped with the site of, or the 4 km buffer extending from, a preceding OWF. In such instances, in the assessment scenario that displacement does occur in the 4 km buffer, then 'double-counting' of red-throated diver displacement would occur. This 'double-counting' was avoided in the analysis using GIS by only accounting for the additional contribution made by the subsequent OWF.

12.4.19 The analysis using GIS, of the OWF development boundary overlaps and the red-throated diver density, coupled with the 'tiered' approach to examining OWFs (detailed in Section 8.5) allowed a number of key quantitative comparisons to be made to inform the in-combination assessment.

12.4.20 Table 12.9 and Table 12.10 identify the relative contribution that Thanet Extension makes to the red-throated diver that overall are predicted to be displaced by those OWFs included in the in-combination assessment because they have geographic proximity to the Outer Thames Estuary SPA. This identifies that when the scenario is applied of 100% displacement within each OWF and no displacement outside then the relative contribution that Thanet Extension makes is 0.7%. This increases to 1.5% under the scenario of 100% displacement within each OWF and within a 4 km buffer around each OWF. The large majority (>98%) of the contribution to red-throated diver potential displacement is made by OWFs that have been consented and are already operational (Tier 1).

Table 12.9: The relative contribution of Thanet Extension to the in-combination displacement of red-throated diver within and adjacent to the Outer Thames Estuary SPA, scenario no displacement outside OWF

Offshore wind farms within and adjacent to the OTE SPA summed by Tier Scenario: 100% displacement in OWF, no displacement outside	Relative contribution to RTD potentially displaced
Tier 1: Operational	98.6%
Tier 2: Under construction	0.3%
Tier 3: Consented but not constructed	0.2%
Tier 4: Application in process – other than Thanet Extension	0.2%
Tier 4: Thanet Extension	0.7%

Table 12.10: The relative contribution of Thanet Extension to the in-combination displacement of red-throated diver within and adjacent to the Outer Thames Estuary SPA, scenario 100% displacement in 4 km buffer

Offshore wind farms within and adjacent to the OTE SPA summed by Tier Scenario: 100% displacement in OWF, 100% displacement in 4 km buffer	Relative contribution to RTD potentially displaced
Tier 1: Operational	98.1%
Tier 2: Under construction	0.2%
Tier 3: Consented but not constructed	0.1%
Tier 4: Application in process – other than Thanet Extension	0.1%
Tier 4: Thanet Extension	1.5%

12.4.21 Table 12.11 and Table 12.12 identify the relative contribution that Thanet Extension makes to the proportions of red-throated diver that are predicted to be displaced relative to the Outer Thames Estuary SPA red-throated diver population. This identifies that when the scenario is applied of 100% displacement within each OWF and no displacement outside then the relative contribution that Thanet Extension makes is 0.08% of the Outer Thames Estuary SPA red-throated diver population. This increases to 0.31% under the scenario of 100% displacement within each OWF and within a 4 km buffer around each OWF. The largest contribution made to red-throated diver potential displacement relative to the Outer Thames Estuary SPA red-throated diver population is made by OWFs that have been consented and are already operational (Tier 1).

Table 12.11: The contribution of Thanet Extension to the in-combination displacement of red-throated diver relative to the OTE SPA population, scenario no displacement outside OWF

Offshore wind farms within and adjacent to the OTE SPA summed by Tier Scenario: 100% displacement in OWF, no displacement outside	Contribution to RTD potentially displaced relative to OTE SPA population
Tier 1: Operational	10.2%
Tier 2: Under construction	0.03%
Tier 3: Consented but not constructed	0.02%
Tier 4: Application in process – other than Thanet Extension	0.03%
Tier 4: Thanet Extension	0.08%

Table 12.12: The contribution of Thanet Extension to the in-combination displacement of red-throated diver relative to the OTE SPA population, scenario 100% displacement in 4 km buffer

Offshore wind farms within and adjacent to the OTE SPA summed by Tier Scenario: 100% displacement in OWF, 100% displacement in 4 km buffer	Contribution to RTD potentially displaced relative to OTE SPA population
Tier 1: Operational	21.0%
Tier 2: Under construction	0.05%
Tier 3: Consented but not constructed	0.03%
Tier 4: Application in process – other than Thanet Extension	0.02%
Tier 4: Thanet Extension	0.31%

12.4.22 Displacement may result in the mortality of a proportion of the birds displaced. Definitive mortality rates associated with displacement for any seabird are not known and precautionary estimates have to be used. The approach taken in the assessment of Thanet Extension is to consider a range of mortality rates, for this species the lower limit is 1% mortality resulting from displacement and the upper limit is 5%. This range has been presented at the Evidence Plan meetings and discussed with stakeholders (Evidence Plan Report Doc. Ref. 8.5). The assessment also considers that resultant mortality in the context of the background mortality in the population. The key parameter is the percentage change relative to background mortality in the Outer Thames Estuary SPA red-throated diver population. Table 12.13 and Table 12.14 identify that change for both 1% and 5% resultant mortality. Table 12.13 identifies the change under the scenario of 100% displacement within each OWF and no displacement outside which for Thanet Extension alone is 0.005% and 0.024% for 1% and 5% resultant mortality and for the in-combination set of OWFs potentially affecting the Outer Thames Estuary SPA population is 0.65% and 3.24% respectively. Table 12.14 identifies the change under the scenario of 100% displacement within each OWF and within a 4 km buffer around each OWF which for Thanet Extension alone is 0.020% and 0.098% for 1% and 5% resultant mortality and for the in-combination set of OWFs potentially affecting the Outer Thames Estuary SPA population is 1.34% and 6.69% respectively. The very small percentage change resulting from Thanet Extension alone identifies that the great majority of the contribution to the in-combination percentage change arises from OWFs that have been consented and are already operational (Tier 1).

Table 12.13: Change in background mortality predicted to result from Thanet Extension alone and for the OWFs in or adjacent to the OTE SPA giving rise to 1% or 5% mortality, scenario no displacement outside OWF

Offshore wind farms within and adjacent to the OTE SPA Scenario: 100% displacement in OWF, no displacement outside	Thanet Extension alone	All OWFs affecting OTE SPA
Increase in mortality from background resulting from 1% resultant mortality by displacement	0.005%	0.65%
Increase in mortality from background resulting from 5% resultant mortality by displacement	0.024%	3.24%

Table 12.14: Change in background mortality predicted to result from Thanet Extension alone and for the OWFs in or adjacent to the OTE SPA giving rise to 1% or 5% mortality, scenario 100% displacement in 4 km buffer

Offshore wind farms within and adjacent to the OTE SPA Scenario: 100% displacement in OWF, 100% displacement in 4 km buffer	Thanet Extension alone	All OWFs affecting OTE SPA
Increase in mortality from background resulting from 1% resultant mortality by displacement	0.020%	1.34%
Increase in mortality from background resulting from 5% resultant mortality by displacement	0.098%	6.69%

12.4.23 The in-combination assessment of potential impacts on red-throated diver, considering the displacement relative to the Outer Thames Estuary SPA population and the change in mortality relative to background mortality in the Outer Thames Estuary SPA population has identified that the contribution of Thanet Extension is very small and is considered not to make a material contribution to potential effects arising from OWFs that have been consented and are already operational.

12.4.24 The proposed Thanet Extension does not make a material contribution to in-combination disturbance and displacement to the red-throated diver feature of the Outer Thames Estuary SPA.

12.4.25 There is, therefore, no potential for AEoI to the red-throated diver feature of the Outer Thames Estuary SPA in relation to in-combination disturbance and displacement effects and therefore, subject to natural change, red-throated diver will be maintained as a feature in the long-term with respect to the potential for adverse effects from in-combination disturbance and displacement.

Offshore Wind Farms collision risk

12.4.26 The potential for collision related mortality to result in an AEoI in-combination with Thanet Extension relates to the following designated sites and the relevant features:

- Alde-Ore Estuary SPA; lesser black-backed gull;
- Alde-Ore Estuary Ramsar; lesser black-backed gull;
- Flamborough and Filey Coast SPA; gannet and kittiwake; and
- St Abb's Head to Fast Castle SPA; kittiwake.

12.4.27 Those sites and the relevant interest features were screened in for LSE prior to the CRM being carried out for the project 'alone' and the attribution of the predicted collisions to the relevant European sites. With the project 'alone' CRM and attribution having been completed the assessment of potential in-combination impacts can be carried out on a quantitative basis.

12.4.28 Table 12.15 summarises the project 'alone' contributions to the relevant SPA, pSPA and Ramsar sites, considering both the number of birds and the percentage addition that such a number of birds makes to baseline mortality of the site population.

Table 12.15: Project 'alone' seabird collision contributions to the relevant SPA, pSPA and Ramsar sites

Site	Seabird interest feature	Collision predictions attributed to the site	Addition to baseline mortality of the site (%)
Alde-Ore Estuary SPA	Lesser black-backed gull	1.52 breeding season	0.043 breeding season
Alde-Ore Estuary Ramsar	Lesser black-backed gull	1.52 breeding season	0.104 breeding season
Flamborough and Filey Coast SPA	Gannet	0.43 spring migration 0.17 autumn migration	0.013 spring migration 0.005 autumn migration
Flamborough and Filey Coast SPA	Kittiwake	0.43 spring migration 0.17 autumn migration	0.006 spring migration 0.002 autumn migration
St Abb's Head to Fast Castle SPA	Kittiwake	0.40 spring migration 0.10 autumn migration	0.006 spring migration 0.002 autumn migration

12.4.29 This quantitative assessment based on the attribution of collision predictions to relevant sites has identified that the proposed Thanet Extension does not make a material contribution to in-combination collision risk for any of the sites that have been assessed. Accordingly, it can be concluded that there is no SPA, pSPA or Ramsar site where the proposed Thanet Extension gives rise to an in-combination adverse effect on integrity.

12.4.30 The proposed Thanet Extension does not make a material contribution to in-combination collision risk to the lesser black-backed gull interest feature of the Alde-Ore Estuary SPA.

12.4.31 The proposed Thanet Extension does not make a material contribution to in-combination collision risk to the lesser black-backed gull interest feature of the Alde-Ore Estuary Ramsar site.

12.4.32 The proposed Thanet Extension does not make a material contribution to in-combination collision risk to the gannet interest feature of the Flamborough and Filey Coast SPA.

12.4.33 The proposed Thanet Extension does not make a material contribution to in-combination collision risk to the kittiwake interest feature of the Flamborough and Filey Coast SPA.

12.4.34 The proposed Thanet Extension does not make a material contribution to in-combination collision risk to the kittiwake interest feature of the St Abb's Head to Fast Castle SPA.

12.5 Onshore Biodiversity

12.5.1 A description of the significance of in-combination effects upon the receptors grouped under 'onshore biodiversity' is provided below.

Construction and Decommissioning

Disturbance (noise & vibration, visual, lighting)

12.5.2 Construction of the Richborough Connection has the potential to cause disturbance to European golden plover forming part of the Thanet Coast and Sandwich Bay SPA population. If undertaken at the same time as construction of Thanet Extension (which is possible in respect of the removal of the existing power line) there is potential for in-combination effects.

12.5.3 A number of embedded mitigation measures are proposed during construction of the Richborough Connection (see Table 12.1). Provided these measures are implemented, given the availability of extensive alternative inland feeding habitat within the vicinity, disturbance during construction would not comprise a likely significant effect (National Grid, 2016). Embedded mitigation implemented during construction and decommissioning of Thanet Extension will avoid disturbance to European golden plover using Pegwell Bay and there will be no AEoI (see section 11.5).

12.5.4 Although it is possible that in-combination effects can be greater than the effects of the two projects considered alone, in this case there is no potential for significant effects during the sensitive winter period for Thanet Extension. Significant effects outside this period are not likely and there will therefore be no AEoI for the Thanet Coast and Sandwich Bay SPA in-combination with the Richborough Connection project.

Disturbance due to possible displacement of visitors from Pegwell Bay Country Park

12.5.5 The residential developments at Discovery Park and Stone Hill Park (if consented), once constructed and occupied, have the potential to increase the number of visitors to Pegwell Bay Country Park. If these additional visitors are using the country park during the construction of Thanet Extension there is potential for them to be displaced to other, more sensitive parts of the Thanet Coast and Sandwich Bay SPA and Ramsar site. There is also potential for the residential developments to directly increase the number of visitors to more sensitive parts of the SPA and Ramsar and there is therefore potential for an in-combination effect with any visitors displaced from the country park during the construction of Thanet Extension. A similar effect is also possible during decommissioning, although the level of any displacement is likely to be lower due to the more limited extent of the works. Whether any increase in visitor numbers as a result of the residential developments will have taken place by the time of construction is not known but a precautionary approach has been taken here which assumes that an increase in visitor numbers is possible.

12.5.6 Both the Discovery Park and Stone Hill Park developments (see Table 12.1) and Thanet Extension (see Table 6.1) include proposals for a range of mitigation measures to reduce the potential for disturbance to non-breeding waterbirds, including qualifying features for the Thanet Coast and Sandwich Bay SPA (European golden plover and ruddy turnstone) and Ramsar site (ruddy turnstone). Following the implementation of the mitigation measures a significant increase in disturbance is not likely and there will be no AEoI for either Thanet Coast and Sandwich Bay SPA or Thanet Coast and Sandwich Bay Ramsar.

Accidental pollution

12.5.7 The construction of the Richborough Connection (in respect of the removal of the existing power line), Discovery Park, Manston Airport and Stone Hill Park developments all have the potential to overlap with the construction of Thanet Extension. In the absence of mitigation there is therefore potential for in-combination effects in respect of accidental pollution to watercourses, which could affect intertidal habitats used by European golden plover (Thanet Coast and Sandwich Bay SPA) and ruddy turnstone (Thanet Coast and Sandwich Bay SPA and Ramsar).

12.5.8 All four of the other developments (see Table 12.1) and Thanet Extension (see Table 6.1) include proposals for a range of mitigation measures to avoid potentially significant effects due to accidental pollution. All five developments will be required to agree detailed mitigation measures with relevant stakeholders prior to construction commencing. Following the implementation of the agreed mitigation measures accidental pollution events are not likely and there will be no AEoI, for either Thanet Coast and Sandwich Bay SPA or Thanet Coast and Sandwich Bay Ramsar, in-combination with other developments.

Operation and Maintenance

Disturbance (noise & vibration, visual, lighting)

12.5.9 An assessment of the operational noise of the biomass CHP plant at Discovery Park concluded that operational noise levels would not have a significant effect on the qualifying features for the Thanet Coast and Sandwich Bay SPA and Thanet Coast and Sandwich Bay Ramsar. Similarly, operational noise from the Thanet Extension substation is not likely to have a significant effect (see Volume 3, Chapter 5: Onshore Biodiversity (Application Ref 6.3.5)).

12.5.10 Although it is possible that in-combination effects could be greater than the effects of the two projects considered alone, in this case the intervening distance between the two projects (>1.5 km) means that cumulative noise will not be significant. There will therefore be no AEoI for either Thanet Coast and Sandwich Bay SPA or Thanet Coast and Sandwich Bay Ramsar due to operational noise in-combination with the biomass CHP project.

12.5.11 If consented, aircraft noise from the re-opened Manston Airport has the potential to cause disturbance to European golden plover and ruddy turnstone using intertidal habitats at Pegwell Bay. If undertaken at the same time as construction, planned O&M or decommissioning works for Thanet Extension, in or adjacent to Pegwell Bay, there is potential for in-combination effects.

12.5.12 The Manston Airport ES states that aircraft disturbance will not be significant owing to the intervening distance, the route of the flight-path and habituation. Although it is possible that in-combination effects could be greater than the effects of the two projects considered alone, in this case there is no potential for in-combination effects during the sensitive winter period due to the proposed timing restrictions for Thanet Extension. Significant effects outside this period are not likely and there will therefore be no AEoI for the Thanet Coast and Sandwich Bay SPA or Thanet Coast and Sandwich Bay Ramsar in-combination with the Manston Airport development.

Displacement during O&M

12.5.13 Construction of the Richborough Connection has the potential to cause displacement of European golden plover from the fields surrounding the new 400kV line, although given the availability of extensive alternative inland foraging habitat within the wider area, operational displacement would not comprise a likely significant effect (National Grid, 2016). Thanet Extension also has potential to cause limited displacement of European golden plover due to the temporary disturbance of supporting intertidal habitats following planned maintenance works, although there would be no AEoI. Noise and visual disturbance during planned maintenance for Thanet Extension will be avoided by the implementation of embedded mitigation measures (Table 6.1).

12.5.14 Although it is possible that in-combination effects can be greater than the effects of the two projects considered alone, in this case the potential for effects is very small and any effects from each project will affect very different habitat types. There will therefore be no AEoI for the Thanet Coast and Sandwich Bay SPA in-combination with the Richborough Connection project.

13 Transboundary statement

13.1.1 The screening process has identified a number of transboundary sites for assessment, with these sites being as follows (including the relevant designated species screened in):

- Bancs des Flandres SCI (harbour porpoise, harbour seal and grey seal);
- Baie de Canche et couloir des trois estuaires (harbour seal and grey seal);
- Vlakte van de Raan (harbour seal and grey seal);
- Voordelta (harbour seal and grey seal);
- Estuaires et littoral picards (baies de Somme et d'Authie) (harbour seal and grey seal);
- Recifs Gris-Nez Blanc-Nez (harbour seal and grey seal);
- Vlaamse Banken (harbour seal and grey seal);
- SBZ1 (grey seal);
- SBZ2 (grey seal);
- SBZ3 (grey seal);
- Ridens et dunes hydrauliques du détroit du Pas-de-Calais (harbour seal and grey seal);

13.1.2 It is of note that all the above sites lie beyond the screening range (20 km) for onshore biodiversity and therefore consideration of the above sites has been focused on the species highlighted above.

13.1.3 Screening of four French sites (Cap Gris Nez SPA, Bancs des Flandres SPA, Estuaire de la Canche SPA and Littoral Seino-marin SPA) classified for a range of non-breeding (wintering and passage migrants) and breeding birds is provided in section 7, with the conclusion being not to screen the sites in (following the approach taken to screening for offshore ornithology in general).

13.1.4 Consideration for an AEoI alone has been addressed in section 11.3 for marine mammals, including in relation to the above sites where marine mammals are highlighted, with all conclusions being no AEoI. The assessment in-combination with other plans or projects (including transboundary projects) has been addressed in section 8 for marine mammals, with all conclusions similarly being no AEoI.

13.1.5 It can therefore be concluded that no AEoI exists for a transboundary effect from Thanet Extension alone or in-combination.

14 Conclusion of the Assessment

14.1.1 A summary of the assessment is presented below, firstly identifying in Table 14.1 the designated sites (together with the relevant feature(s)) screened in for effect in relation to Thanet Extension alone, including the conclusion on AEoI. The determination of AEoI in-combination is summarised in Table 14.2.

Table 14.1: Summary of the Potential for Adverse Effect from Thanet Extension Alone

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect		
			Construction	Operation	Decommissioning
Sites primarily designated for subtidal and benthic intertidal habitats					
Thanet Coast SAC	Chalk reefs only	Temporary habitat loss/ disturbance	No AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
		Increased suspended sediment and associated deposition	No AEoI	No AEoI	Similar to and potentially less than those outlined in the construction phase.
		Change in physical processes	N/A	No AEoI	N/A
	Chalk reefs Submerged or partially submerged sea caves	Accidental pollution	No AEoI	No AEoI	No AEoI
Margate and Long Sands SAC	Sand banks which are slightly covered by sea water all the time	Increased suspended sediment and associated deposition	No AEoI	No AEoI	Similar to and potentially less than those outlined in the construction phase.
		Change in physical processes	N/A	No AEoI	N/A
		Accidental pollution	No AEoI	No AEoI	No AEoI
Thanet Coast & Sandwich Bay SPA – see Onshore Biodiversity					
Thanet Coast & Sandwich Bay Ramsar– see Onshore Biodiversity					
Sites primarily designated for Marine Mammals					
Southern North Sea cSAC/SCI	Harbour porpoise	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
		Accidental pollution	no AEoI	no AEoI	no AEoI

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect		
			Construction	Operation	Decommissioning
Single transboundary site for harbour porpoise: Bancs des Flandres SCI	Harbour porpoise	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
		Accidental pollution	no AEoI	no AEoI	no AEoI
Eight transboundary sites for harbour seal: Bancs des Flandres Baie de Canche et couloir des trois estuaires Vlakte van de Raan Voordelta Estuaires et littoral picards (baies de Somme et d'Authie) Recifs Gris-Nez Blanc-Nez Vlaamse Banken Ridens et dunes hydrauliques du détroit du Pas-de-Calais	Harbour seal	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
Eleven transboundary sites for grey seal: Bancs des Flandres Baie de Canche et couloir des trois estuaires Vlakte van de Raan Voordelta Estuaires et littoral picards (baies de Somme et d'Authie) Recifs Gris-Nez Blanc-Nez Vlaamse Banken SBZ 1 SBZ 2 SBZ 3 Ridens et dunes hydrauliques du détroit du Pas-de-Calais	Grey seal	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
Sites primarily designated for Offshore Ornithology					
Outer Thames Estuary SPA	Red-throated diver	Disturbance and Displacement	No AEoI	No AEoI	No AEoI

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect		
			Construction	Operation	Decommissioning
	Common tern Little tern	Collision risk	N/A	No AEoI	N/A
Flamborough and Filey Coast SPA	Guillemot Razorbill	Disturbance and Displacement	No AEoI	No AEoI	No AEoI
	Gannet Kittiwake	Collision risk	N/A	No AEoI	N/A
Northumberland Marine SPA	Guillemot	Disturbance and Displacement	No AEoI	No AEoI	No AEoI
Farne Islands SPA	Guillemot	Disturbance and Displacement	No AEoI	No AEoI	No AEoI
St Abb's Head to Fast Castle SPA	Guillemot Razorbill	Disturbance and Displacement	No AEoI	No AEoI	No AEoI
	Kittiwake	Collision risk	N/A	No AEoI	N/A
Foulness (Mid-Essex Coast Phase 5) SPA	Sandwich tern	Collision risk	N/A	No AEoI	N/A
Alde-Ore Estuary SPA	Lesser black-backed gull	Collision risk	N/A	No AEoI	N/A
Alde-Ore Estuary Ramsar	Lesser black-backed gull	Collision risk	N/A	No AEoI	N/A
Sites primarily designated for Onshore Biodiversity					
Thanet Coast & Sandwich Bay SPA	Non-breeding European golden plover and ruddy turnstone	Temporary habitat loss/ disturbance of intertidal habitats	No AEoI	No AEoI	No AEoI
		Increased suspended sediment and associated deposition affecting intertidal habitats	No AEoI	No AEoI	No AEoI
		Noise and visual disturbance	No AEoI	No AEoI	No AEoI

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect		
			Construction	Operation	Decommissioning
		Disturbance due to possible displacement of recreational visitors	No AEoI	N/A	No AEoI
		Accidental pollution	No AEoI	No AEoI	No AEoI
		Spread of INNS	No AEoI	N/A	No AEoI
Thanet Coast & Sandwich Bay Ramsar	Non-breeding ruddy turnstone Wetland invertebrate assemblage	Temporary habitat loss/ disturbance	No AEoI	No AEoI	No AEoI
		Increased suspended sediment and associated deposition affecting intertidal habitats	No AEoI	No AEoI	No AEoI
		Noise and visual disturbance	No AEoI	No AEoI	No AEoI
		Disturbance due to possible displacement of recreational visitors	No AEoI	N/A	No AEoI
		Accidental pollution	No AEoI	No AEoI	No AEoI
		Spread of INNS	No AEoI	N/A	No AEoI

Table 14.2: Summary of the Potential for Adverse Effect from Thanet Extension In-combination

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect		
			Construction	Operation	Decommissioning
Sites primarily designated for subtidal and benthic intertidal habitats					
No projects screened in for in-combination assessment and therefore no in-combination effect					
Sites primarily designated for Marine Mammals					
Southern North Sea cSAC/SCI	Harbour porpoise	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
		Accidental pollution	no AEoI	no AEoI	no AEoI
One transboundary site for harbour porpoise, harbour seal and grey seal: Bancs de Flandres	Harbour porpoise Harbour seal Grey seal	Accidental pollution	no AEoI	no AEoI	no AEoI
Five transboundary sites for harbour seal: Bancs des Flandres Recifs Gris-Nez Blanc-Nez Vlakte van de Raan Voordelta Vlaamse Banken	Harbour seal	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.
Nine transboundary sites for grey seal: Bancs des Flandres Vlakte van de Raan Voordelta Recifs Gris-Nez Blanc-Nez Vlaamse Banken SBZ 1 SBZ 2 SBZ 3	Grey seal	Underwater noise	no AEoI	N/A	Similar to and potentially less than those outlined in the construction phase.

Designated Site	Relevant Features	Potential for Effect	Conclusion on Adverse Effect		
			Construction	Operation	Decommissioning
Ridens et dunes hydrauliques du détroit du Pas-de-Calais					
Sites primarily designated for Offshore Ornithology					
Outer Thames Estuary SPA	Red-throated diver	Disturbance and Displacement	No AEoI	No AEoI	No AEoI
Alde-Ore Estuary SPA	Lesser black-backed gull	Collision risk	N/A	No AEoI	N/A
Alde-Ore Estuary Ramsar	Lesser black-backed gull	Collision risk	N/A	No AEoI	N/A
Flamborough and Filey Coast SPA	Gannet Kittiwake	Collision risk	N/A	No AEoI	N/A
St Abb's Head to Fast Castle SPA	Kittiwake	Collision risk	N/A	No AEoI	N/A
Sites primarily designated for Onshore biodiversity					
Thanet Coast and Sandwich Bay SPA	European golden plover Ruddy turnstone	Disturbance (noise & vibration, visual and lighting) Disturbance due to possible displacement of recreational visitors to Pegwell Bay Country Park Displacement (O&M) Accidental pollution	No AEoI	No AEoI	No AEoI
Thanet Coast and Sandwich Bay Ramsar	Ruddy turnstone	Disturbance (noise & vibration, visual and lighting) Disturbance due to possible displacement of recreational visitors to Pegwell Bay Country Park Accidental pollution	No AEoI	No AEoI	No AEoI

15 References

- Amec Foster Wheeler (2018). Manston Airport DCO EIA: Environmental Statement.
- APEM (2016). Assessment of Displacement Impacts of Offshore Windfarms and Other Human Activities on Red-throated Divers and Alcids. Natural England Commissioned Report NECR227.
- Balmer, D., Gillings, S., Caffrey, B., Swann, R., Downie, I. and Fuller, R. (2013), Bird Atlas2007-11: The Breeding and Wintering Birds of Britain and Ireland. Thetford: British Trust for Ornithology.
- Band, W. (2012). Using a collision risk model to assess bird collision risks for offshore windfarms. The Crown Estate Strategic Ornithological Support Services (SOSS) report SOSS-02. SOSS Website. Original published Sept 2011, extended to deal with flight height distribution data March 2012.
- BEIS (2018). Record of Appropriate Assessment – East Anglia ONE Offshore Windfarm.
- Bellebaum, J., Diederichs, A., Kube, J., Schulz, A. and Nehls, G. (2006). Flucht und Meidedistanzen überwinternder Seetaucher und Meeresenten gegenüber Schiffen auf See. Ornithol. Rundbr. Mecklenburg-Vorpommern 45, Sonderheft 1: 86-90.
- Bradbury, G., Trinder, M., Furness, B., Banks, A., Caldow, R. and Hume, D. (2014). Mapping Seabird Sensitivity to Offshore Wind Fams. PLoS ONE 9(9): e103366. Doi:10.1371/journal.pone.0106366.
- Buro Happold. 2014a. Discovery Park: Environmental Statement
- Buro Happold. 2014b. Discovery Park: Updated Information for Appropriate Assessment
- CIEEM, 2016. Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial. Freshwater and coastal.
- Collop, C., Stillman, R.A., Garbutt, A., Yates, M.G., Rispin, E. & Yates, T. (2016). Variability in the area, energy and time costs of wintering waders responding to disturbance. Ibis. DOI: 10.1111/ibi.12399.
- Cook, A.S.C.P., Humphries, E.M., Masden, E.A. and Burton, N.H.K. (2014). The avoidance rates of collision between birds and offshore turbines (Thetford: British Trust for Ornithology).
- Cramp, S. and Perrins, C.M. (series 1977 – 1994). Birds of the Western Palearctic (BWP): Handbook of the Birds of Europe, the Middle East and North Africa. Oxford University Press.
- Cuming, N. & Bowdrey, J (2010) Orthotylus rubidus - recent records from Suffolk & Essex. Het News, 2nd Series, no.16, Autumn 2010.
- Cutts, N., Phelps A. and Burdon, D. (2009). Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA, Institute of Estuarine and Coastal Studies, University of Hull.
- Dahne, M., Gilles, A., Peschko, V., Krugel, K., Sundermeyer, J. and Siebert, U. (2013). Effects of pile-driving on harbour porpoises (*Phocoena phocoena*) at the first offshore wind farm in Germany. Environmental Research Letters, Volume 8, Number 2.
- European Commission (2018): Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC
- European Commission (2001). Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC
- Furness, B. and Wade, H. (2012). Vulnerability of Scottish Seabirds to Offshore Wind Turbines. Report for Marine Scotland, The Scottish Government.
- Furness, R.W., Wade, H. and Masden, E.A. (2013). Assessing vulnerability of seabird populations to offshore wind farms. Journal of Environmental Management 119: 56-66.
- Furness, R.W. (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, Number 164.
- Garthe, S. & Hüppop, O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology 41: 724-734.
- Gillings, S. & Sutherland, W.J. (2007). Comparative diurnal and nocturnal diet and foraging in Eurasian Golden Plovers Pluvialis apricaria and Northern Lapwings Vanellus vanellus wintering on arable farmland. Ardea 95: 243-257
- Godfrey, A. (2010) Assessing Saltmarsh SSSIs for Invertebrate Assemblage Condition in England. Report to Natural England, February 2010.
- Henderson, A. & Sutherland, M. (2017) Numbers and distribution of Golden Plovers in the Thanet Coast and Sandwich Bay SPA during the winter of 2016/2017. A report to Natural England (March 2017)
- Hodgson, I. (2016). Thanet Coast Turnstone (Arenaria interpres) monitoring January – February 2016. A Report to Natural England
- IAMMWG. 2013. Draft Management Units for marine mammals in UK waters (June 2013). JNCC.
- JNCC, NE, and CCW. 2010. The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area.

- JNCC, 2009. Part 1: Background to site selection. Version 4 September 2009. http://jncc.defra.gov.uk/pdf/SAC-selection-background-T37.pdf
- JNCC, 2016. Harbour Porpoise (*Phocoena phocoena*) possible Special Area of Conservation: Southern North Sea. Draft Conservation Objectives and Advice on Activities http://jncc.defra.gov.uk/pdf/SouthernNorthSeaConservationObjectivesAndAdviceOnActivities.pdf
- JNCC, 2017a. A potential approach to assessing the significance of disturbance against conservation objectives of the harbour porpoise cSACs. Discussion document version 3.0
- JNCC, 2017b. Harbour porpoise SACs noise management stakeholder workshop. Report.
- JNCC and Natural England (2013). Interim advice on Habitats Regulations Assessment (HRA) screening for seabirds in the non-breeding season.
- JNCC and Natural England (2013). JNCC and Natural England Suggested Tiers for Cumulative Impact Assessment. [Submission to the East Anglia ONE Hearing].
- Joint Nature Conservation Committee, Natural England, Northern Ireland Environment Agency, Natural Resources Wales and Scottish Natural Heritage. (2014). Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review (Peterborough, JNCC).
- King, S., Maclean, I., Norman, T. and Prior, A. (2009). Developing Guidance on Ornithological Cumulative Impact Assessment for Offshore Wind Farm Developers (London: COWRIE Ltd).
- MacArthur Green (2016). Quantifying impact assessments for selected seabird populations: A review of recent literature and understanding. Report commissioned by Vattenfall, Statkraft and ScottishPower Renewables.
- Maclean, I.M.D., Wright, L.J., Showler, D.A. and Rehfisch, M.M. (2009). A Review of Assessment Methodologies for Offshore Windfarms (Thetford: British Trust for Ornithology).
- Masden, E. (2015) Developing an avian collision risk model to incorporate variability and uncertainty. Scottish Marine and Freshwater Science Vol 6 No 14. Edinburgh: Scottish Government, 43pp. DOI: 10.7489/1659-1.
- Maynard, L.D. and Ronconi, R.A. (2018). Foraging behaviour of Great Black-blacked Gulls Larus marinus near an urban centre in Atlantic Canada: evidence of individual specialization from GPS tracking. Marine Ornithology 46: 27–32.
- MMO (undated). Record of Appropriate Assessment Regulation 61 of the Conservation of Habitats and Species Regulations 2010, Statutory Instrument 2010/490 and Regulation 25 of the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (Statutory instrument 2007/1842– The “Habitats Regulations”). Hornsea Project ONE.
- Natural England, 2000. North East Kent European marine sites comprising: Thanet Coast candidate Special Area of Conservation (cSAC), Thanet Coast and Sandwich Bay Special Protection Area (SPA), Sandwich Bay candidate Special Area of Conservation (cSAC) English Nature’s advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.
- Natural England, 2005. Citation for Special Area of Conservation (SAC): Thanet Coast.
- Natural England (2014). Written Summary of Oral Case submitted at Deadline IV to the Hearing in to the Application for Hornsea Offshore Wind Farm Project One.
- Natural England (2014). *Site Improvement Plan: North East Kent (Thanet)*. Improvement Programme for England's Natura 2000 Sites (IPENS), Planning for the Future. V1.0, 08/10/14.
- Natural England, 2015. Condition assessment of Thanet Coast Special Area of Conservation. Natural England Commissioned Report NECR165.
- Natural England (2018). Classification citation: Flamborough and Filey Coast SPA UK9006101. EC Directive 2009/147/EC on the Conservation of Wild Birds Special Protection Area (SPA). Version 2.0 August 2018.
- Natural England and JNCC: Interim Advice Note (2012). Presenting information to inform assessment of the potential magnitude and consequences of displacement of seabirds in relation to Offshore Windfarm Developments.
- National Grid (2016). No Significant Effects Report (Habitats Regulations Assessment Screening): National Grid (Richborough Connection Project) Order.
- Natural England (2016). European Site Conservation Objectives for Outer Thames Estuary Special Protection Area and potential Special Protection Area, Site Code: UK9020309. Version 1.
- Natural England and JNCC (2015). Departmental Brief: Outer Thames Estuary potential Special Protection Area (November 2015).
- O’Brien, S, H., Webb, A., Brewer, M, J. and Reid, J, B. (2012). Use of kernel density estimation and maximum curvature to set Marine Protected Area boundaries: Identifying a Special Protection Area for wintering red-throated divers in the UK. Biological Conservation 156: 15.21.
- Percival, S. (2015). Ornithology Review for the Thanet and Ormonde Offshore Wind Farm Extensions. Ecology Consulting, Durham.
- PINS (2013). Habitat Regulations Assessment relevant to nationally significant infrastructure projects.
- PMSS (2013). Nemo Link UK Marine Environmental Statement, Volume 1 (Fareham: PMSS Ltd.)

- Robinson, R.A. (2017) BirdFacts: profiles of birds occurring in Britain & Ireland (BTO Research Report 407). BTO, Thetford (http://www.bto.org/birdfacts , accessed September 2017)
- Royal HaskoningDHV (2013). Thanet Offshore Wind Farm Ornithological Monitoring 2012-2013 (Post-construction Year 3). Royal HaskoningDHV Report for Vattenfall Wind Power Ltd.
- Schwemmer, P., Mendel, B., Sonntag, N., Dierschke, V. and Garthe, S. (2011). Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications, 21(5), 2011, pp. 1851-1860.
- Sea Mammal Research Unit (SMRU), 2011. Summary of seal count and telemetry data from the Humber area. Report to SMart Wind.
- Statutory Nature Conservation Bodies. (2017). Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments.
- Strategic Marketing. (2016). Dover Visitor Survey, Pegwell Bay and Sandwich Bay. Report for Dover District Council.
- Stroud, DA, Chambers, D, Cook, S, Buxton, N, Fraser, B, Clement, P, Lewis, P, McLean, I, Baker, H & Whitehead, S (eds). (2001). The UK SPA network: its scope and content. JNCC, Peterborough.
- Thaxter, C. B., Lascelles, B., Sugar, K., Cook A., Roos, S., Bolton, M., Langston, R. and Burton, N. (2012), Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156: 53-61.
- Thompson, P.M., McConnell, B.J., Tollit, D.J., MacKay, A., Hunters, C. Racey, P.A., 1996. Comparative distribution, movements and diet of harbour and grey seals from the Moray Firth, N.E. Scotland. Journal of Applied Ecology, 33, pp. 1572-1584.
- Tougaard, J., Buckland, S., Robinson, S. and Southall, B. (2014). An analysis of potential broad-scale impacts on harbour porpoise from proposed pile driving activities in the North Sea. Report of an expert group convened under the Habitats and Wild Biords Directives – Marine Evidence Group.
- Wade, H.M., Masden, E.A., Jackson, A.C. and Furness, R.W. (2016). Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments. Marine Policy 70 (2016) p 106-113.
- Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. and Baillie, S.R.(eds). (2002), The Migration Atlas: movements of the birds of Britain and Ireland. London:T&AD Poyser.
- Widgery. J. (2007) Excursions into East Anglia in 2006 & 2007. Het News, 2nd Series, no.10, Autumn 2007.
- Wright, L.J., Ross-Smith, V.H., Massimino, D., Dadam, D., Cook, A.S.C.P. and Burton, N.H.K. (2012). Assessing the risk of offshore windfarm development to migratory birds designated as features of UK Special Protection Areas (and other Annex I species). (Thetford: British Trust for Ornithology).
- WSP. (2018). Stone Hill Park Environmental Statement. April 2018.