Outer Dowsing Offshore Wind

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Offshore Artificial Nesting Structures Ecological Evidence & Roadmap

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Abbreviations

Acronym	Expanded name
ACAP	Agreement on the Conservation of Albatrosses and Petrels
ANS	Artificial Nesting Structure
AON	Apparently Occupied Nests
BEIS	Department for Business, Energy & Industrial Strategy (now the Department for Energy Security and Net Zero (DESNZ))
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CIMP	Compensation Implementation and Monitoring Plan
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero, formerly Department of Business, Energy and Industrial Strategy (BEIS), which was previously Department of Energy & Climate Change (DECC)
EEZ	European Economic Zone
EU	European Union
FFC	Flamborough and Filey Coast
GT R4 Ltd	The Applicant. The special project vehicle created in partnership between Corio Generation (a wholly owned Green Investment Group portfolio company), Gulf Energy Development and TotalEnergies
HRA	Habitats Regulations Assessment

Acronym	Expanded name
ICES	International Council for the Exploration of the Sea
JNCC	Joint Nature Conservation Committee
LEB	Looming Eye Buoy
LED	Light-emitting diode
MMO	Marine Management Organisation
MRF	Marine Recovery Fund
NSIP	Nationally Significant Infrastructure Project
OOEG	Offshore Ornithology Engagement Group
OWF	Offshore Wind Farm
PEIR	Preliminary Environmental Information Report
RIAA	Report to Inform Appropriate Assessment
RSPB	Royal Society of the Protection of Birds
SAC	Special Area of Conservation
SBWG	Seabird Bycatch Working Group
SNCB	Statutory Nature Conservation Body
SoS	Secretary of State
SPA	Special Protection Area
UV	Ultraviolet

Definitions

Term	Definition
Array area	The area offshore within the PEIR Boundary within which the generating stations (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling are positioned.
Baseline	The status of the environment at the time of assessment without the development in place.
deemed Marine Licence (dML)	A licence administered under the Marine and Coastal Access Act 2009. The licence set out within a Schedule within the Development Consent Order (DCO).
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP) from the Secretary of State (SoS) for Department for Energy Security and Net Zero (DESNZ).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of an impact with the sensitivity of a receptor, in accordance with defined significance criteria.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Outer Dowsing Offshore Wind	The Project.

Term	Definition
Preliminary Environmental Information Report (PEIR)	The PEIR is written in the style of a draft Environmental Statement (ES) and provides information to support and inform the statutory consultation process in the pre-application phase. Following that consultation, the PEIR documentation will be updated to produce the Project's ES that will accompany the application for the Development Consent Order (DCO).
Pre-construction and post-construction	The phases of the Project before and after construction takes place.
The Applicant	GT R4 Ltd. The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf Energy Development (GULF)), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company), TotalEnergies and GULF.
The Project	Outer Dowsing Offshore Wind including proposed onshore and offshore infrastructure
Wind turbine generator (WTG)	All the components of a wind turbine, including the tower, nacelle, and rotor.

1 Summary

1.1 Background

1.1.1 This report provides a review of the ecological evidence for offshore artificial nesting structures to increase the annual recruitment of black-legged kittiwake *Rissa tridactyla* (hereafter kittiwake), common guillemot, *Uria aalge* (hereafter guillemot), and razorbill, *Alca torda,* into the regional population of the southern North Sea. The report also provides a roadmap for the delivery of this compensation measure on a without prejudice basis for impacts to the Flamborough and Filey Coast (FFC) Special Protection Area (SPA), including initial site-selection, initial design criteria and an overview of how the success of the measure will be monitored.

1.1.2 The draft Report to Inform Appropriate Assessment (RIAA; Document 7.1) has concluded that there would be no Adverse Effect on Integrity (AEoI) to the FFC SPA for guillemot and razorbill, with a conclusion of AEoI (in-combination) not ruled out at this stage for kittiwake. Without prejudice compensation has been developed for these species in response to stakeholder concerns (guillemot and razorbill) and in the absence of a final conclusion for kittiwake (in-combination).

1.2 Key Findings

1.2.1 Evidence is presented of all three species colonising offshore structures in UK waters. Kittiwakes have been recorded breeding on at least 26 offshore platforms and are present across many more. There is a growing evidence base to suggest that guillemot and razorbill breed on offshore platforms and that artificial nesting may be a suitable compensation option to increase recruitment into the population. It is therefore expected all three species will readily colonise an offshore structure if environmental conditions are favourable.

1.2.2 An initial site-selection workstream identified broad regions of the North Sea that may be favourable for a new structure or a repurposed platform to be located. Several criteria were used including proximity to key foraging grounds, connectivity with existing colonies, whist avoiding key infrastructure and protected areas.

2 Introduction

2.1 Project Background

2.1.1 GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop the Project. The Project will be located approximately 54km from the Lincolnshire coastline in the southern North Sea. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm), export cables to landfall, onshore cables, and connection to the electricity transmission network, and ancillary and associated development (see Volume 1, Chapter 3: Project Description for full details).

2.2 Document Purpose

2.2.1 The draft RIAA undertaken for the Project was not able to rule out a potential in-combination AEoI to the kittiwake feature at the FFC SPA at the current phase of the assessment and therefore consideration of potential compensation measures is provided in this report. Additionally, though the draft RIAA did not identify any AEoI for guillemot and razorbill at FFC SPA, this report aims to support the identification of potential 'without prejudice' compensation measures for these species in the event the Secretary of State (SoS) disagrees with the assessment results.

2.2.2 The primary species of interest for this measure is kittiwake as there is a large regional population in the southern North Sea and artificial nesting is considered a viable compensation measure for a potential AEoI at the FFC SPA by Natural England (see Section 5 "Consultation" of Document 7: Draft RIAA). This report should be read alongside the Project's Ornithology Compensation Strategy (Part 7, Document 7.2).

3 Methodology

3.1.1 Initially, a literature review was undertaken to determine the evidence of kittiwake, guillemot and razorbill breeding on offshore structures and establish the potential benefits of creating artificial structures for these species. Literature searches included, but were not limited to, scientific journals, government reports, relevant websites (e.g. RSPB), and grey literature. A large body of evidence has already been compiled by Hornsea Project Four (Orsted, 2021a; Orsted 2021b; Orsted, 2022) and therefore where possible these reports have been referenced rather than providing duplicated material.

3.1.2 Data on the presence of kittiwake, guillemot and razorbill on offshore structures has also been collected in the southern North Sea, in the UK, Norway and The Netherlands. This data was compiled by Orsted for Hornsea Project Four and is presented in an annex to this report. Additionally, the Applicant has undertaken its own surveys of oil and gas platforms in proximity to the Project array area, the results of which are also presented in Section 5.

4 Evidence for the Effectiveness of Offshore Artificial Nesting Structures

4.1 Background

4.1.1 Offshore artificial structures offer additional nesting space to seabirds which may provide a vital refuge to buffer against declining coastal populations. In areas where seabird populations are in a favourable and/or increasing condition, offshore structures offer additional nesting space away from areas where competition for resources are already high. Structures can be ideally situated in terms of proximity of key foraging areas, and in areas where birds are likely to recruit into key nearby populations (e.g. those in need of compensation). Furthermore, there is often reduced predation pressure offshore, which in addition to increased prey availability, can increase the productivity to levels higher than at natural onshore colonies.

4.2 Kittiwake

Introduction

4.2.1 The UK kittiwake populations have experienced considerable declines over the last 40 years, with an overall decline of 40% since 1975 (Descamps *et al.,* 2017; BirdLife International, 2019; JNCC, 2022). Despite population declines, kittiwakes are continuing to colonise artificial structures. Provision of artificial structures may therefore provide a vital refuge to buffer against declining coastal populations, by providing nesting habitat to increase recruitment of birds back into the bio-geographic population.

Evidence of kittiwake breeding on artificial structures

4.2.2 There is considerable evidence that kittiwake do not exhibit a preference between natural or artificial nesting sites (Coulson, 2011). The first recording of kittiwakes breeding on artificial structures was in the early 1990s in the Norwegian Sea (Christensen-Dalsgaard *et al.*, 2019), and they have been breeding successfully on offshore platforms in the UK since at least the late 1990's (Unwin, 1999). There are now more than 26 offshore sites with a confirmed breeding kittiwake population in northwest Europe (Christensen-Dalsgaard *et al*., 2019; Orsted, 2021a).

4.2.3 Despite the global decline, kittiwakes continue to breed offshore in large numbers. Collating data from just two studies (Christensen-Dalsgaard *et al*., 2019; Orsted, 2021a) found over 2000 Apparently Occupied Nests (AONs). With populations of this size nesting offshore, the consequent juvenile dispersal is likely to provide a significant contribution to declining kittiwake populations (Christensen-Dalsgaard *et al.,* 2019).

4.2.4 The numbers of kittiwakes nesting on both urban locations and artificial structures appear to be stable or even increasing (JNCC, 2022, Turner, 2010 & 2018). Additionally, a study in Norway on breeding kittiwakes on offshore oil rigs indicated high minimum productivity (number of chicks fledged per nest) rates of 0.61-1.07, exceeding those from both natural populations and coastal man-made structures (Christensen-Dalsgaard *et al*., 2019). This pattern was repeated in colonies in the southern North Sea, with five out of six colonies having higher productivity on offshore platforms compared with natural east coast colonies (Orsted, 2021a). This may be explained by the closer proximity of offshore structures to potential foraging sites, alongside greater distance from land-based predators (Daunt *et al.,* 2002; Lewis *et al.,* 2001).

Colonisation rate

4.2.5 Owing to a lack of data on colonisation of artificial structures, predicting the growth rate of a kittiwake colony on a new artificial site is challenging. However, artificial growth patterns appear to follow those seen at natural sites. New colonies are usually formed by 3-20 young birds, and for the first few years colony growth will be rapid, doubling in size each year for the first few (2-4) years (Coulson, 2011). Following these initial years, colony growth will slow to a rate of approximately 10-20% per annum (Coulson, 2011; Kidlaw, 2005). Early growth of the colony is highly dependent on successfully attracting immigrants and prospective breeders. Since a relatively small proportion of young kittiwake (as few as 11%) remain at their natal sites (Coulson and Coulson, 2008), it is likely that strategic placement of an artificial structure would create high potential for the development of a new colony from dispersing individuals.

4.3 Guillemot and Razorbill

Introduction

4.3.1 Both guillemot and razorbill are members of the auk family (Alcidae) which form large breeding colonies on cliffs during the reproductive season, typically between March and July. During this time, they forage close to the coast and generally feed on small fish and crustaceans. The rest of the year they spend at sea. Although there is limited evidence that these auk species breed on offshore structures there is robust evidence that they do congregate on them in large numbers.

4.3.2 It can be difficult to tell whether guillemot or razorbill are actively incubating an egg because unlike kittiwake, they tend not to use much in the way of nesting material. Therefore, a more detailed survey of offshore structures is planned for 2023 which will include assessment of the behaviour and location of auk species to provide insight as to whether offshore structures may be used as a compensation measure for these species too.

Evidence of guillemot and razorbill breeding on artificial structures

4.3.3 Evidence of guillemot and razorbill breeding on artificial structures is limited in comparison to kittiwakes. However, surveys covering sixteen offshore structures in the southern North Sea found evidence of ~100 guillemots and 13 razorbills potentially nesting on platforms on one structure (Orsted, 2021a). Surveys also showed further bird loafing on lower sections of the structure.

4.3.4 Outside of the UK, guillemot and razorbill have been recorded breeding on an artificial structure on the Swedish island of Gotland. The structure consisted of ledges on the outside of a cliffside building, with an in-built lab and monitoring system (Hentati-Sundberg *et al.,* 2012). Despite the availability of natural nesting space on the island, ~75 pairs of guillemot and 10 pairs of razorbill have been recorded breeding on the structure, supporting the idea that some individuals of both these species will colonise an artificial structure in preference to natural nesting sites (Stockholm Resilience Centre, 2020).

Colonisation rate

4.3.5 Predicting potential growth rates of guillemot and razorbill colonies on artificial sites is challenging owing to a lack of monitoring, with most UK evidence being anecdotal. However, monitoring at the Stockholm Resilience Centre (2020) over 12 years has showed that guillemot numbers on an artificial nesting site rose to 75 pairs, and razorbill numbers to 10 pairs.

4.3.6 Across other species, colonisation rates appear to reflect those of natural populations. For examples, black guillemots breeding in artificial nests showed a 22-fold increase in the number of breeding pairs over a 16-year period (The Black Guillemots of Cooper Island, 2021).

5 Summary of the Kittiwake Census on Offshore Structures

5.1 Background

5.1.1 In July 2022 an ornithological census of 19 offshore oil and gas platforms in the southern North Sea was carried out by RSK Biocensus, commissioned by the Applicant. The primary aim of the census was to quantify the number of birds breeding on offshore structures in proximity to the Project array area. This section summarises the survey report, including a brief outline of the methods and results.

5.2 Methods

5.2.1 There were 19 offshore structures identified within a 20km buffer of the Project array, detailed within the report Table 5.1. Boat-based ornithological surveys were undertaken by two ornithologists in accordance with the Ornithological Monitoring Plan (RSK Biocensus, 2022) and following methodology described in the JNCC advice note which sets out 19 principles for surveying (Thompson, 2021). Data was collected from a visual assessment of the platforms from outside the 500m safety zone around the structures.

5.2.2 Photographs were taken of areas that appeared to have nesting kittiwakes, sketches of the structures were made, and the number of nests were recorded. The number of birds recorded nesting on the structures is likely to be an underestimate because the distance of the survey vessel from the platforms preclude counting any nests that were underneath the platform superstructure.

5.3 Results

5.3.1 Kittiwakes were recorded on 15 of the 19 structures surveyed and were confirmed to be nesting on at least six. A total of over 664 kittiwakes and over 186 apparently occupied nests (AONs) were observed on the structures. A total of 117 AONs were recorded within the Project array area and therefore there are at least 234 breeding individuals within the array area during the breeding season. In addition, guillemot and razorbill were both recorded on structures, though evidence of breeding was not confirmed.

5.3.2 Visual observations confirmed that the nests were predominantly located on the I-beams and were comprised primarily from seaweed. The data has not been analysed to determine whether birds favoured certain nesting locations, however, no immediate trends were apparent. The results are summarised in Table 5.1.

5.4 Next steps

5.4.1 It is recommended that repeat annual surveys are undertaken to update the baseline data. Where nests are recorded, productivity could be assessed if agreements are in place to allow survey vessels to enter the safety zone. This would also ensure more accurate counts could be obtained.

Table 5.1: Kittiwake counts and nest counts on the offshore platforms. Identifier has been randomly assigned to anonymise platforms.

Identifier	Nest Count	Individual Count	Manned or Unmanned	Operational status
1	0	150+	Unmanned	Operational
2	0	0	Unmanned	Operational
3	0	21	Unmanned	Operational
4	-	-	Unmanned	Operational
5	67+	129	-	-
6	-	-	Manned	Operational
7	-	-	-	-
8	-	-	Manned	Operational
9	-	-	Unmanned	Operational
10	-	-	Manned	Operational
11	-	-	Manned	Operational
12	0	17	Unmanned	Operational
13	?	55	Unmanned	Operational
14	0	20	Unmanned	Operational
15	-	-	Unmanned	Operational
16	20	124	Unmanned	Operational
17	32	64	Unmanned	Operational
18	0	39	Unmanned	Operational
19	52	40+	Unmanned	Non-operational
20	65	80	Unmanned	Non-operational
21	0	4	Unmanned	Operational
22	0	7	Manned	Operational
23	-	-	Manned	Operational
24	17	56	Unmanned	Operational
25	0	48	Unmanned	Operational

6 Roadmap for Delivery

6.1 Consultation

6.1.1 Prior to Application, without prejudice compensation measures will be developed and consulted on during the Expert Topic Group (ETG) meetings. If granted consent, the Project will establish a steering group named the Offshore Ornithology Engagement Group (OOEG) to assist on the implementation, reporting and any other relevant matters. The OOEG will also aim to engage with relevant stakeholders throughout the process.

6.1.2 Extensive consultation with stakeholders via the OOEG will be undertaken before and during construction to ensure cooperation across all monitoring aspects of the artificial nesting structure. Results of monitoring processes will also be discussed with the OOEG. Detailed delivery proposals outlining this process will be presented in the Kittiwake, Guillemot and Razorbill CIMP.

6.2 Design Considerations

6.2.1 A design and engineering assessment will be undertaken by the Applicant following identification of a suitable site. Discussions with relevant parties (e.g. ornithology experts and engineering professionals) will be required for the structure design. Considerable work has already been undertaken by Hornsea Project Four in their design of artificial nesting structures for kittiwake and gannet (Orsted, 2021b). Consequently, much of this work may be built on in terms of design for kittiwake, however additional discussion would be needed to ensure adequate design features for guillemot and razorbill if compensation for these species were required.

6.3 Artificial structure design

6.3.1 To ensure successful colonisation of target species, species-specific nesting criteria that represent natural nest design will be factored into the structure. Kittiwake and guillemot/razorbill have different nesting requirements, therefore if multiple species are taken forward these can be incorporated into different sections of one platform. Evidence from offshore oil and gas platforms has shown auks and kittiwake breeding on different areas of the same structure[1].

[1] Orsted, (2021). Compensation measures for FFC SPA Offshore Artificial Nesting Ecological Evidence. Volume B2 Annex 7. 1. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010098/EN010098-000504-B2.7.1%20RP%20Volume%20B2%20Annex%207.1%20Compensation%20measures%20for%20FFC%20SPA%20Offshore%20Artificial%20Nesting%20Ecological%20Evidence.pdf (Accessed May 2023).

Kittiwake

6.3.2 Kittiwake nests should represent horizontal nesting 'ledges', with vertical walls and a vertical drop to water below ledges should be created. It is important that ledges should be made narrow enough to discourage predation by large gulls. Considering size, each nest should be roughly 40cm length along the ledge, 40cm vertical space between the ledge and the above structure, and 15cm depth/protrusion of ledge.

Guillemot and Razorbill

6.3.3 Both guillemot and razorbill nest in similar locations, including ledges, rock platforms and among boulders (Plumb, 1965; Hipfner and Dussereault, 2001; Harris *et al.* 1996).

6.3.4 Given the prevalence of predation of large gulls on auk species, especially guillemot (JNCC 2021a), structures may benefit from a roof or overhang to deter swooping avian predators.

6.4 Monitoring

6.4.1 Monitoring will form a vital component of the compensation measure in order to evaluate the success of the artificial structure. The monitoring process will be discussed with relevant stakeholders through the OOEG.

6.4.2 The monitoring process will aim to provide information on the number of birds breeding on the artificial structures, alongside demographic rates (i.e. breeding success, survival). Methodology for monitoring will follow pre-defined methods provided by Walsh *et al.* (1995) and the Joint Nature Conservation Committee's (JNCC) Seabird Monitoring Programme (SMP) (JNCC, 2022). Seabird data will be compared to existing natural colonies to assess the success of the artificial structure in comparison to established natural colonies.

6.4.3 Following construction of the Project, monitoring of the artificial structure will continue throughout the lifetime of the Project, with details to be outlined in the CIMP. Final monitoring methodology will be developed and influenced by the finalised structure design and location, though monitoring will likely be in the form of remote monitoring using cameras on the structure in order to minimise disturbance. A more detailed methodology will be provided within a 'without prejudice' monitoring plan at Application.

6.4.4 If monitoring reveals that the artificial structure is not delivering compensation at the expected and/or required level, then adaptive management measures will be used to improve the measure.

6.5 Adaptive management

6.5.1 Adaptive management will be undertaken if the compensation measure is less effective than planned, aiming to improve the effectiveness of the measure.

6.5.2 Adaptive measures will be discussed with relevant stakeholders as part of the OOEG, aiming to identify a list of potential approaches. Potential measures previously discussed for other projects have included the provision of nesting material and additional protection from the elements. A detailed monitoring and adaptive management plan will be provided in the CIMP.

6.6 Decommissioning of the Artificial Structure

6.6.1 Consultation with relevant authorities will be undertaken to determine the requirement for decommissioning of the artificial structure towards the end of the operational life of the Project.

6.7 Site Selection

6.7.1 The Applicant is currently progressing through a detailed site selection process to identify an offshore location in UK waters where an artificial structure, which provides additional breeding opportunities to kittiwake, guillemot and razorbill can be established. The site selection process primarily highlights regions of the southern North Sea that are ecologically beneficial and technically optimum for either option of the site selection process.

6.7.2 This is an ongoing process, however, initial site-selection criteria and search areas are presented within this section. The site selection process for the offshore artificial nesting structure was undertaken via a heatmapping exercise. Ecological criteria are a primary consideration but both technical and commercial parameters were also considered.

Selection Criteria

6.7.3 Considerable site selection work has been undertaken and presented by Hornsea Four (Orsted, 2022). This site-selection has culminated in the selection of an optimal area of search for a new structure to accommodate breeding kittiwakes (see Figure 6.2). The site selection methodology presented here builds on this work, using similar agreed criteria.

Overlap with Existing Colonies

6.7.4 Site selection only considered sites in English, North Sea waters where nesting space availability is likely to be limiting population growth. Owing to the greater availability of natural nesting habitat along the Scottish coast, these areas were not considered.

6.7.5 A limited number of SPAs are available in English waters for kittiwake, and consequently on the east coast, almost all impacts from OWFs are apportioned back to the Flamborough and Filey Coast SPA. Compensation measures will likely aim to deliver breeding birds back to this site, though where this is not possible (e.g. due to the existing conservation objectives and site improvement plans already in place), the aim will be to deliver birds back into the bio-geographic population.

6.7.6 In the UK, tracking data is available from many seabird colonies, which with predictive modelling techniques has been used to map the key foraging areas for kittiwakes in UK waters (Cleasby *et al.,* 2020; Wakefield *et al.*, 2017) (see Figure 6.1). These distributions have been informed by tracking data and distance from known kittiwake colonies on the east coast mainland. If additional data had been available to add to these models, specifically tracking data from other North Sea colonies to the south of FFC SPA and undocumented colonies at offshore locations, key foraging areas may be seen to extend further into the southern North Sea. This would most likely be to the east, along the frontal regions where many offshore platforms are located.

6.7.7 To date, evidence suggests that offshore kittiwake colonies occur in the area south of the Flamborough front (Pingree and Griffiths, 1978). There is a lack of knowledge surrounding where these birds forage and if these areas are shared with onshore nesting birds. This region is outside the core foraging range from FFC SPA but is known to support birds from FFC SPA (Cleasby *et al.*, 2020). Kittiwakes can display high foraging site fidelity (Irons, 1998, Harris *et al.*, 2020), and there is some evidence that kittiwake avoid foraging in areas that are populated with a higher number of birds from a neighbouring colony (Wakefield *et al.,* 2017). Therefore, when determining the location for an artificial nesting structure it will be important to choose an area that will avoid competition for resources (in so far as possible) with birds from FFC SPA and other SPAs because it could result in a reduced breeding success of kittiwake at SPAs.

6.7.8 Site selection for an artificial structure will factor in competition for resources alongside proximity to a source location. Based on the studies presented above, a distance of approximately 10km from a large kittiwake colony is the optimal scenario for promoting quick recruitment and population growth. However, this proximity may also result in the artificial colony and natural source colony directly competing for the same food resources and drawing individuals away from SPA colonies. Site selection should therefore find a compromise between these two distances. In this analysis the area between the core foraging zone (mean foraging range) and the mean-maximum foraging range was considered an appropriate compromise to promote colonisation while reducing competition for resources.

6.7.9 Statutory stakeholders have agreed that site selection should avoid the core foraging range distance from FFC SPA (54.7km for kittiwakes, 33.1km for guillemot and 61.3km for razorbill), whist maintaining some connectivity with FFC SPA to allow colony interchange to be a possibility (Mean-maximum foraging range = 156.1km) (Orsted, 2021c). The search area for a breeding colony would therefore be located beyond approximately 55km and broadly within 150km from the FFC SPA. Where possible the locations of existing offshore colonies will also be considered as their locations highlight regions of suitable habitat, where kittiwakes are successfully breeding. Other information has also been considered such as, information on prey distribution, presence of designated sites, existing infrastructure and planned, under construction and operational windfarm locations.

Avoiding Protected Sites and Infrastructure

6.7.10 There are constraints from existing infrastructure and protected sites in the southern North Sea, including oil and gas platforms, cables and pipelines, aggregates and dredging areas, OWFs, protected wrecks, marine conservation zones (MCZs), special areas of conservation (SACs) and SPAs. Ideally, an offshore nesting structure should avoid all of these areas.

6.7.11 It is currently unknown how artificial nesting structures will be designed and how breeding birds will be protected. Given the density of OWFs in the southern North Sea it is likely that any birds breeding on an offshore structure will be impacted by windfarms. However, where possible an artificial nesting structure should be located far enough away from OWFs to avoid unnecessary collisions of breeding birds with turbines. Initially, areas outside a 15km buffer around all operational and planned OWFs in the southern North Sea region were considered. All areas outside of oil and gas platforms, pipelines, aggregates and dredging areas, and shipping safety buffers were considered. The Applicant is undertaking continued consultation with The Crown Estate and relevant stakeholders to ensure commercial criteria used for site selection are appropriate and robust.

Oil and Gas Platforms

6.7.12 Across Norwegian waters and the southern North Sea, platforms which have been colonised by kittiwake are located between 35 -170km offshore. Orsted undertook a kittiwake census of some oil and gas platforms in the southern North Sea in June and July 2021, with this data available in an aggregated form though due to data sharing requirements, the raw data is not available and has not been used in this initial site selection phase.

Ecological Criteria (Prey Availability)

6.7.13 Ecological criteria have also been considered, with prey availability being a key factor determining the likelihood of colonisation. Key prey species for kittiwake, guillemot and razorbill include small fish, especially sandeel in the northern North Sea, alongside sprats, clupeids and juvenile whiting (Chivers *et al.*, 2012, Bull *et al.*, 2004, Furness and Tasker, 2000, Markones *et al.*, 2009). Kittiwake distribution at sea during the breeding season is largely driven by factors which influence prey availability (Cox *et al.*, 2013), within the constraints of foraging range from colony for breeding adults. In general, shorter foraging distances are linked to higher breeding success (e.g. Daunt *et al.,* 2002, Lewis *et al.,* 2001). Therefore, an offshore breeding site may enable birds to breed closer to foraging sites, reducing energetic costs associated with finding food, which is likely to result in increased productivity. The primary variables used to identify favourable kittiwake foraging habitat are tracking data and sandeel distribution.

6.7.14 Additionally, oceanographic features can be a reliable predictor of prey availability. Kittiwakes can only access prey in the top metre of the water column, so they are often associated with hydrographic features such as shelf breaks and tidal fronts which concentrate prey near the water surface (Leopold, 1993, Skov and Durinck, 1998, Markones, 2007). Areas where the water column is well-stratified with the movement of tidal currents over uneven topography is thought to be important in creating surface aggregations of sandeels that kittiwakes exploit (Embling *et al.*, 2012).

Location Determination

6.7.15 A selection process was undertaken by ruling out or favouring locations based on the seven criteria outlined in Table 6.1. The area of search for a suitable location for an artificial nesting structure is the southern North Sea up to the Scottish border and out to the limits of the UK EEZ. The same criteria are to be used for each of the three species under consideration. However, the results of the kittiwake analysis are prioritised and presented in this report due to the plan HRA requirement to provide compensation for this species (Figure 6.2; The Crown Estate, 2022). This work has highlighted broad areas of search for offshore artificial nesting structures across the southern North Sea.

6.7.16 All designated SPAs with kittiwake, guillemot or razorbill as a protected or assemblage feature on the east coast of England were included in the analysis. This resulted in the FFC SPA for kittiwake, guillemot and razorbill, Coquet Island SPA for kittiwake and the Farne Islands SPA for kittiwake and guillemot.

6.7.17 The optimum location for an artificial nesting structure will be outside of the core foraging areas of kittiwake from FFC SPA to avoid competition for resources but it should have some connectivity to maximise the probability that the structure will be colonised over time. Therefore, the area between the mean foraging range and mean-maximum foraging ranges of kittiwake from FFC, Farne Islands or Coquet Island SPAs was considered appropriate as an area of search (Figure 6.1). The same process was also followed for guillemot and razorbill from the relevant SPAs to determine their connectivity with a potential structure.

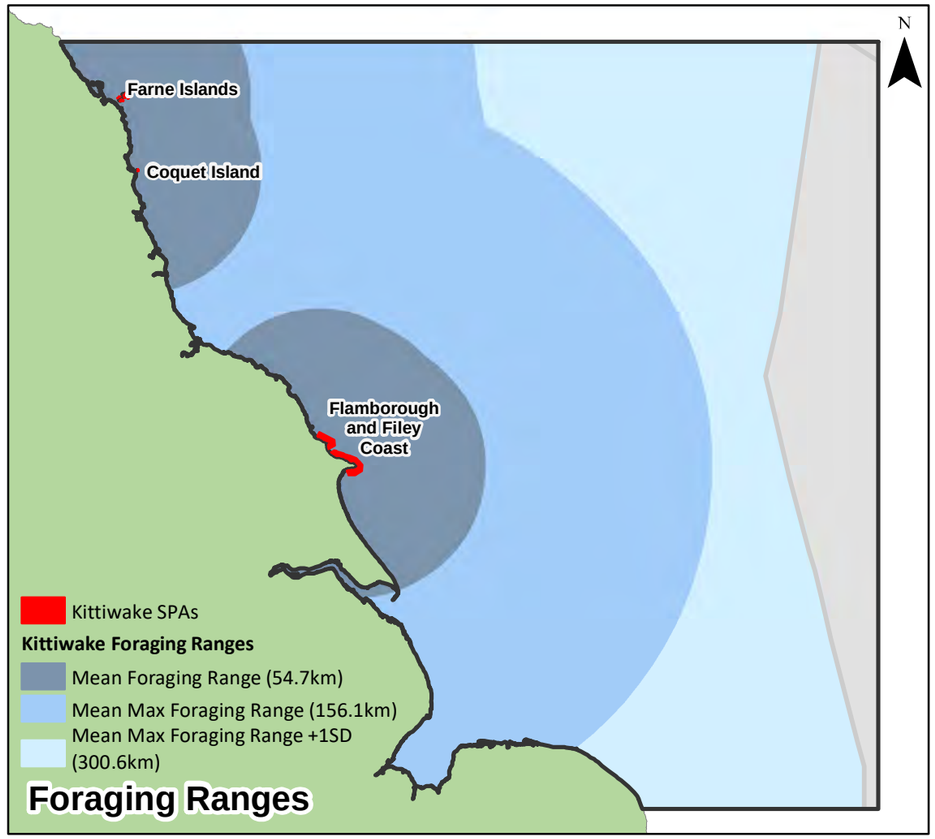
Table 6.1: Criterion used to determine the optimum location for offshore artificial nesting structures in the southern North Sea.

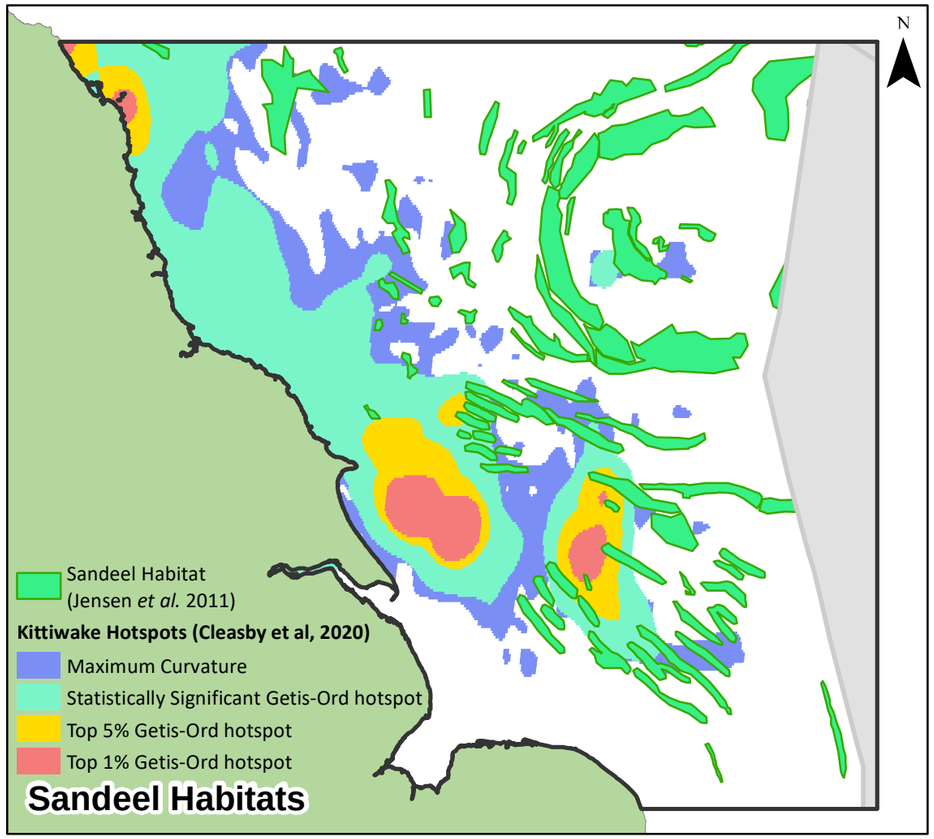
Category	Criteria	Description
Overlap with existing colonies	Minimise competition for resources with existing colonies	Outside mean (core) foraging ranges from SPAs. Avoid overlap of artificial nesting structures foraging area with that of existing North Sea colonies.
	Colonisation potential	Proximity to existing colonies – Inside mean-maximum foraging range of a SPA.
Avoiding protected sites and infrastructure	Outside of designated sites	Artificial nesting structure should be situated outside of the southern North Sea SAC,SPAs and MCZs.
	Away from offshore wind developments	>15km from existing and planned windfarms.
	Away from infrastructure	Outside of known oil and gas platforms, cables and pipelines, aggregates and dredging areas, protected wrecks, and shipping safety buffers.
Prey availability	Sandeel distribution	Proximity to sandeel grounds based on the distribution provided by Jensen *et al.,* 2011.
	Foraging areas	Overlap with core foraging areas for kittiwake, as identified from tracking data using percentage at-sea utilization distribution from Cleasby *et al.*, 2020.

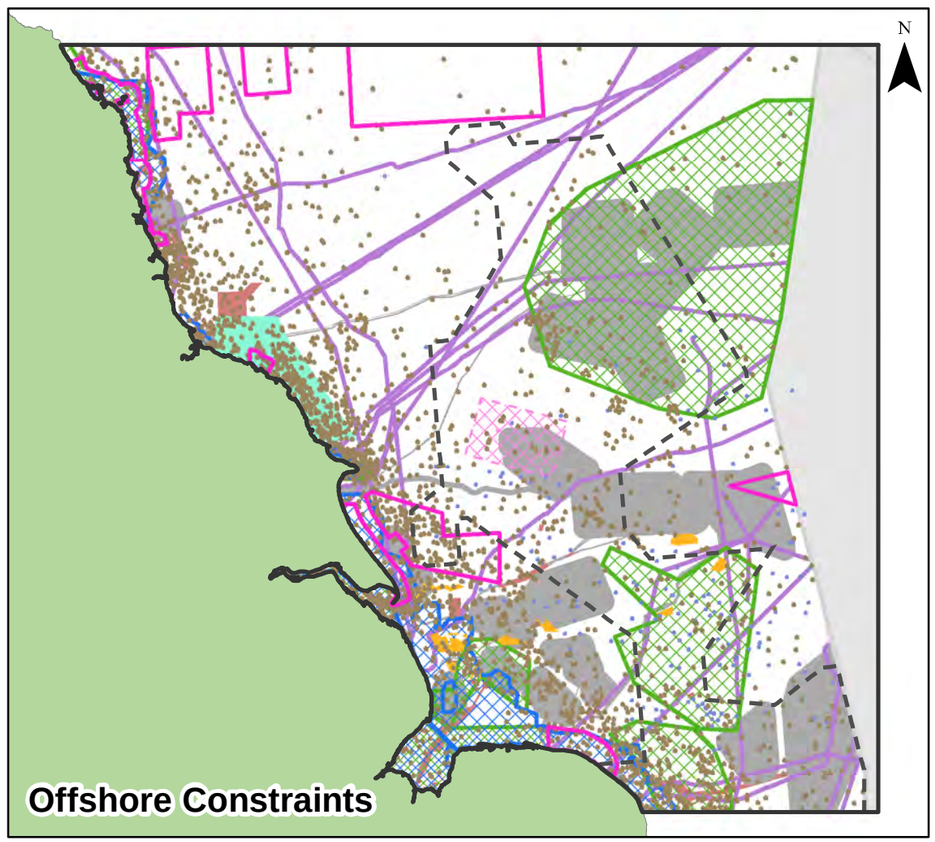
Preliminary results

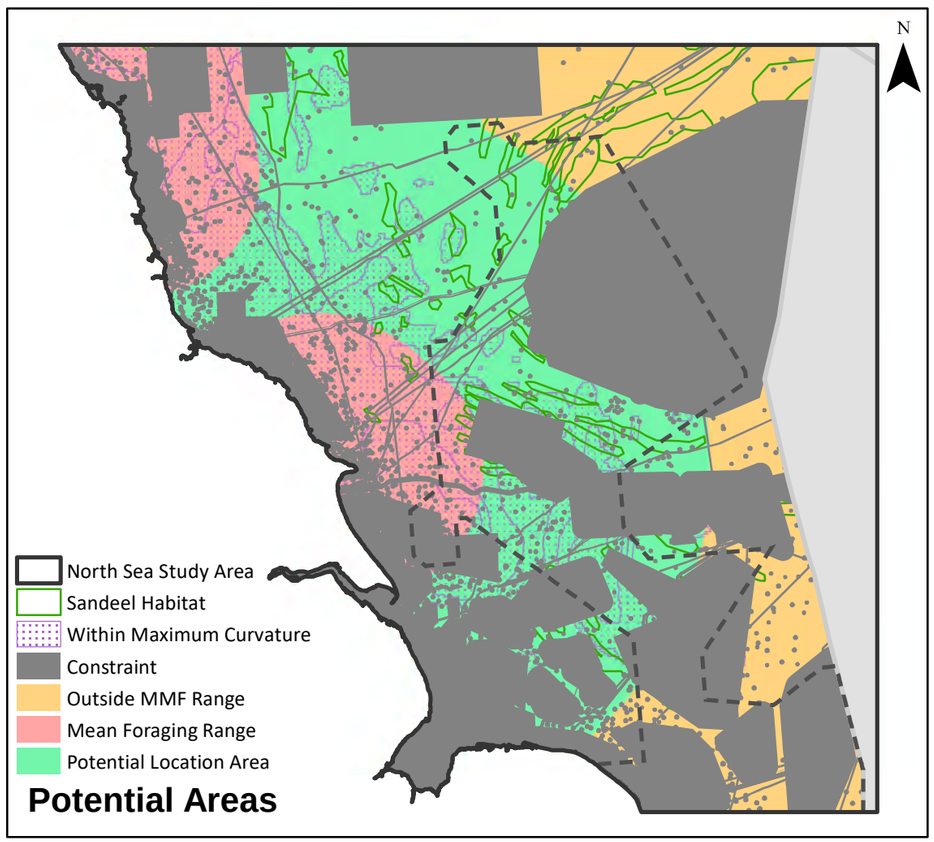
6.7.18 As demonstrated in Figure 6.2 there are large portions of the southern North Sea that meet the site-section criteria but there are some clear trends. Options are restricted in the southern areas, from north Norfolk to roughly the location of the Hornsea Projects. Within this area there are relatively few suitable areas to place a structure. In addition, as can be seen by the pink and black squares, Hornsea Project Four is already considering a structure in some of these areas.

6.7.19 More availability exists to the north, however these areas are not as close to the core foraging habitat of kittiwake and are further away from the Project, which may make the construction and maintenance of a structure more challenging or costly.



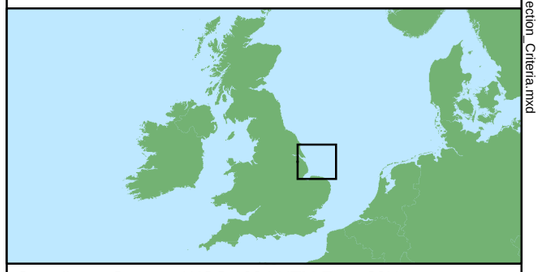






Legend

- North Sea Study Area
- Non UK Seas
- Wreck
- Carbon Capture and Storage
- Aggregates Area
- Mining Area
- Disposal Site
- Oil and Gas 500m Safety Zone
- Subsea Cables with 500m buffer
- Wind Farm with 5km buffer and ECC
- Marine Conservation Zones
- Special Area of Conservation
- SAC (Southern North Sea)
- Special Protection Area



Coordinate System: WGS 1984 UTM Zone 30N

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Scale: 1:2,750,000

Preliminary Environmental Information Report

Overview of Site Selection Criteria displayed Protected Site Foraging Ranges, Prey Habitat and Offshore Constraints

Figure 6.1

OUTER DOWSING OFFSHORE WIND

Date: 09/05/2023
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Farne Islands SPA

Coquet Island SPA

Flamborough and Filey Coast SPA

Northumberland National Park

North York Moors National Park

Yorkshire Dales National Park

Peak District National Park

Newcastle upon Tyne

Sunderland

Durham

Middlesbrough

Darlington

Scarborough

Ripon

York

Burnley

Bradford

Leeds

Wakefield

Huddersfield

Rochdale

Barnsley

Doncaster

Manchester

Stockport

Sheffield

Scunthorpe

Grimsby

Chesterfield

Lincoln

Skegness

Mansfield

Stoke-On-Trent

Nottingham

Derby

Grantham

Boston

Loughborough

The Broads Authority

Norwich

Great Yarmouth

Legend

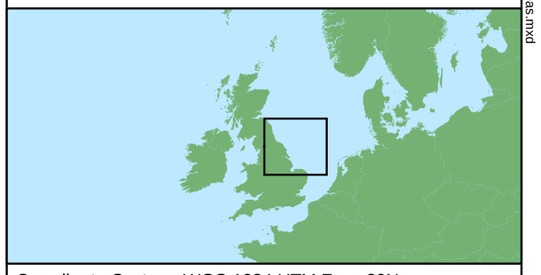
- Array Area
- North Sea Study Area
- Optimal Areas for Kittiwake Artificial Nesting
- Proposed ANS Structure (HOW04)
- Constraint (including OWF 15km Buffer)
- Southern North Sea SAC
- Shipping - Vessel Density AIS >500 (MMO)
- Sandeel Habitat (Jensen *et al.* 2011)
- Special Protection Areas (SPA)

Kittiwake Foraging Ranges

- Mean Foraging Range
- Mean Max Foraging Range
- Outside Mean Max Foarging Range

Kittiwake Hotspots (Cleasby et al, 2020)

- Maximum Curvature
- Statistically Significant Getis-Ord hotspot
- Top 5% Getis-Ord hotspot
- Top 1% Getis-Ord hotspot



Coordinate System: WGS 1984 UTM Zone 30N

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Preliminary Environmental Information Report

Suitable Areas for an Offshore ANS considering all Seven Site Selection Criteria. Areas in Bright Green are Optimal, in terms of Prey Availability

Figure 6.2

OUTER DOWSING OFFSHORE WIND

Date: 09/05/2023
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Revision: 0.1

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Engineering Considerations

6.7.20 Following identification of the preferred ecological areas for the provision of an artificial nesting structure, a number of engineering parameters were considered to facilitate a technically advantageous design for the platform, namely:

- Bathymetry between 15 – 30m;
- Presence of hard substrate at the surface; and
- Quaternary sediment thickness (>20m).

6.7.21 Data on these three constraints were collated from open-source datasets (British Geological Survey and EMODnet) and overlain on the heatmapping. For both the hard substrate and quaternary sediment thickness layers, the data resolution available was insufficient to use for site selection and as such, these two constraints were consequently removed from the constraints analysis with both being considered surmountable through design following more detailed site investigations.

6.7.22 Following the application of the bathymetric constraint to the ecologically favourable areas (Figure 6.3), the number of preferred areas was consequently reduced to five discrete areas south of Dogger Bank. Of these five areas, it was considered that there was no specific determinators between each site, and consequently, it was determined to progress with the two closest areas to the Project, one to north-west and one to south-east of the array area (Figure 6.4), as these would be most economical to service due to relative proximity to the Project.

6.7.23 One of these preferred areas was adjacent to and partially overlapped with the area identified by Hornsea Four, which has been included within the northwest area as it has been agreed as suitable with stakeholders. Further consideration will be required for this site dependant on progress by Hornsea Four. In the event that Hornsea Four do not progress with a new structure here, the area may be used as with other areas. However, if Hornsea Four do use the site, there may be potential to work collaboratively to work in the same area (e.g. on the same structure, or to create a hub of structures).

6.7.24 Both these sites have been included within the Project boundaries within the PEIR and will be further evaluated and refined through consultation with relevant stakeholders, including Natural England, RSPB, The Crown Estate and other marine users.

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6200000 6100000 6000000 5900000

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Farne Islands SPA

Coquet Island SPA

Flamborough and Filey Coast SPA

Northumberland National Park

North York Moors National Park

Yorkshire Dales National Park

Peak District National Park

The Broads Authority

Newcastle upon Tyne, Sunderland, Durham, Middlesbrough, Darlington, Scarborough, Ripon, York, Burnley, Bradford, Leeds, Wakefield, Huddersfield, Rochdale, Barnsley, Doncaster, Scunthorpe, Grimsby, Manchester, Stockport, Sheffield, Chesterfield, Lincoln, Skegness, Mansfield, Stoke-On-Trent, Nottingham, Derby, Grantham, Boston, Loughborough, Norwich, Great Yarmouth

Legend

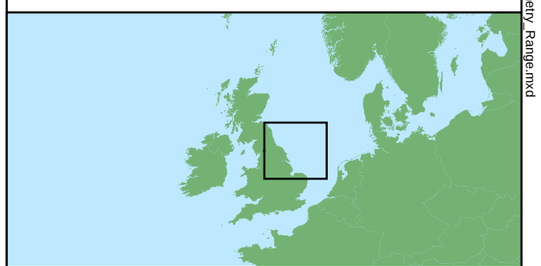
- Array Area
- North Sea Study Area
- Proposed ANS Structure (HOW04)
- Constraint (including OWF 15km Buffer)
- Southern North Sea SAC
- Sandeel Habitat (Jensen *et al.* 2011)
- Special Protection Areas (SPA)
- Outside Mean Max Foarging Range

Kittiwake Hotspots (Cleasby et al, 2020)

- Maximum Curvature
- Statistically Significant Getis-Ord hotspot
- Top 5% Getis-Ord hotspot
- Top 1% Getis-Ord hotspot

Depth (m)

- <15
- 15 - 30
- >30



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Preliminary Environmental Information Report

Preferred Bathymetry Range (15 - 30m) for Location of an ANS

Figure 6.3

OUTER DOWSING OFFSHORE WIND

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Revision: 0.1

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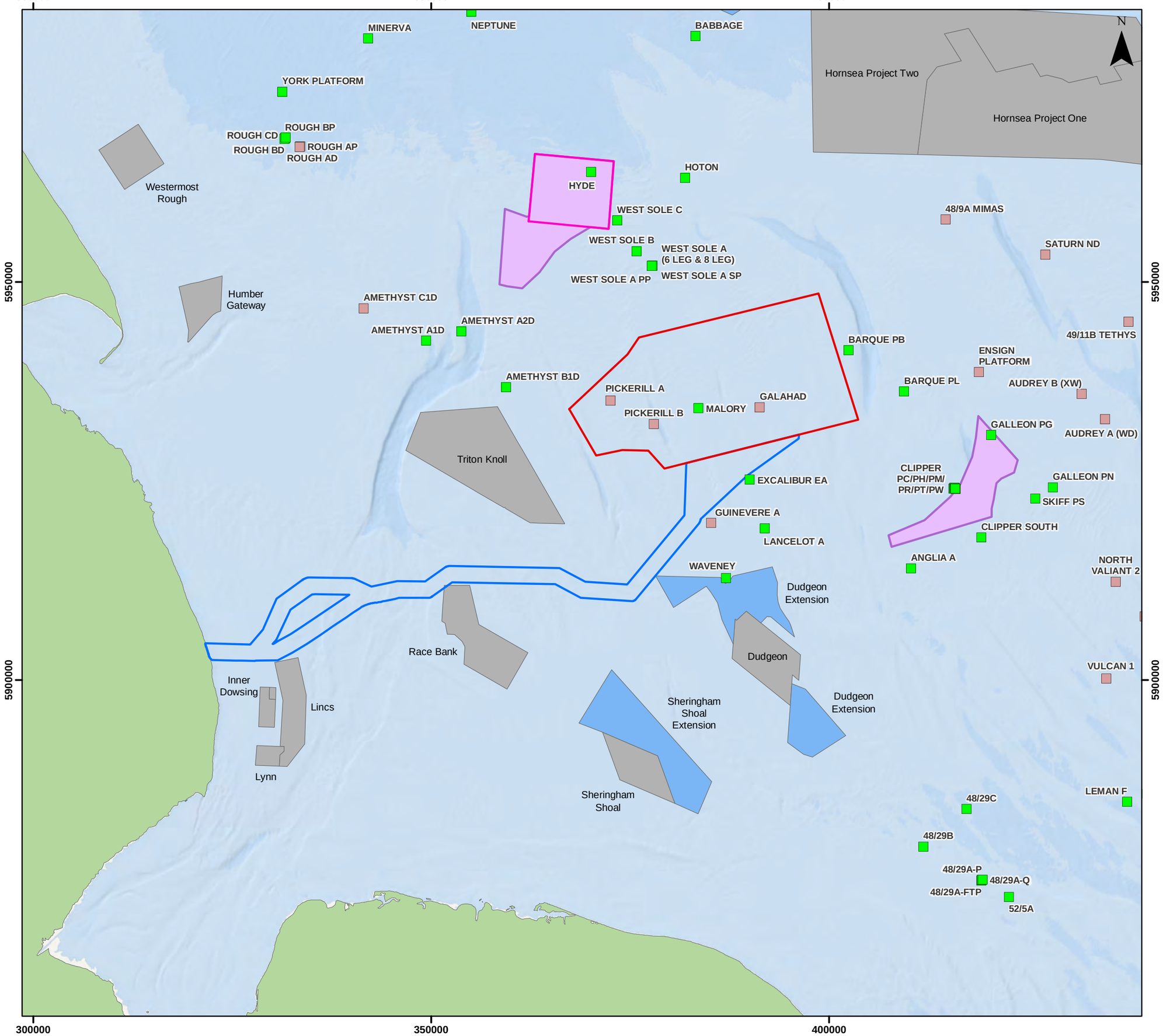
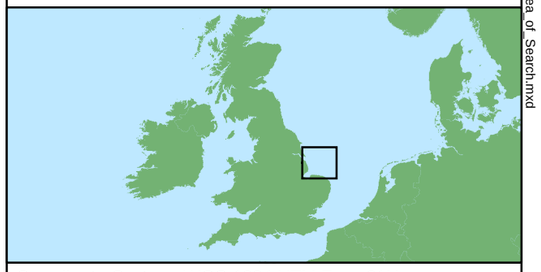


Legend

- Array Area
- Offshore Export Cable Corridor
- Artificial Nesting Structure Areas of Search
- Proposed ANS Structure (HOW04)
- Windfarm (Operational)
- Windfarm (In Planning)

Platforms (Status)

- Active
- Abandoned / Not In Use / Removed



Coordinate System: WGS 1984 UTM Zone 31N

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Scale: 1:450,000

Preliminary Environmental Information Report

Preferred ANS Area of Search

Figure 6.4

OUTER DOWSING OFFSHORE WIND

Date: 17/05/2023
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6.8 Key Consents and Legal Requirements

6.8.1 The Applicant intends to include consent to develop, build and maintain any artificial nesting structure through the Development Consent Order (DCO) and associated deemed Marine Licences (dMLs) for the wider Project. As such, consent for activities to construct the artificial nesting structure and operate it for the lifetime of the Project will be sought through the DCO Application with all impacts predicted to arise from the works fully assessed through the Environmental Statement and associated documentation that will accompany the DCO application.

6.9 Funding

6.9.1 A funding statement will be submitted as part of the DCO Application, which will include consideration of the costs associated with any artificial nesting structure.

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