Hornsea Three Kittiwake Implementation & Monitoring Plan (KIMP)

Appendix A: Design Report

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Document Control

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Acronyms

Acronym	Definition
ANS	Artificial Nesting Structure(s)
AONB	Area of Outstanding Natural Beauty
CCTV	Closed-circuit television
DEFRA	Department for Environment, Food and Rural Affairs
ESC	East Suffolk Council
HBC	Hartlepool Borough Council
HAT	Highest Astronomical Tide
JNCC	Joint Nature Conservation Committee
MCA	Maritime and Coastguard Agency
MMO	The Marine Management Organisation
OOEG	Offshore Ornithology Engagement Group
RSPB	Royal Society for the Protection of Birds
SSSI	Site of Special Scientific Interest
SPA	Special Protection Area
RAMSAR	Wetlands of international importance designated under the criteria of the Ramsar Convention on Wetland
RNLI	Royal National Lifeboat Institution
UKCEH	UK Centre for Ecology & Hydrology

1 Design Process and Principles

1.1.1.1 This report describes the design process, design principles and design proposals for the Artificial Nesting Structures (ANS) that are required to deliver the ecological compensation requirements for the Hornsea Project Three Offshore Windfarm (hereafter 'Hornsea Three') in the East Anglia and North East search zones.

1.1.1.2 The design objective is to create a series of world class exemplar ecological installations through a process that involves a close, interactive, and iterative working relationship between stakeholders and the team of specialists required to deliver the project, including ecologists, architects, engineers, planning consultants and ornithologists. The relationship between NIRAS (kittiwake ecologists) and LDA Design (architect, landscape architect and planning consultant) has been especially critical to ensure the ANS proposals are rooted in providing the best ecological conditions for ANS success.

1.1.1.3 The design process has involved the presentation and discussion of design thinking and proposals at the regular Offshore Ornithology Engagement Group (OOEG) meetings. Presentation information has included written and graphic content describing proposals as well as live 3D models to help communicate proposals and their 3-dimensional appearance as clearly as possible. OOEG members include:

Core members:

- Orsted;
- Natural England;
- The Royal Society for the Protection of Birds (RSPB); and
- Marine Management Organisation (MMO).

Advisory body members:

- The Department for Environment, Food and Rural Affairs (DEFRA);
- The Joint Nature Conservation Committee (JNCC); and
- UK Centre for Ecology and Hydrology (UKCEH).

Hornsea Three consultants:

- Collaborative Environmental Advisers (independent chair);
- NIRAS;
- GoBe Consultants; and
- LDA Design.

1.1.1.4 At the outset of the project a set of universal ecological design principles were developed by NIRAS that would inform an ecologically driven design process for the ANS. These principles were shared and agreed with the OOEG. Once the ecological design principles were established, a pattern book (**Appendix 1**) was created to act as the primary tool to inform the design of the ANS. The pattern book was also shared with the OOEG to help provide an agreed set of holistic design principles that would inform the site specific ANS design proposals. These design principles were agreed with the OOEG at Technical Panel #3 on 26/05/2021.

1.1.1.5 The pattern book (**Appendix 1**) comprises a set of 28 interrelated design patterns that form the basis for ANS design approach in any appropriate location. Patterns 01 - 18 provide ecological performance requirements (the agreed design principles) with patterns 19 - 28 providing landscape performance requirements for the ANS. The ecological patterns are concerned firstly with the creation of successful nesting conditions and the ability to monitor and potentially adapt the ANS over time in response to research findings or changes in environmental conditions. The landscape patterns are concerned with the appropriate contextual integration of ANS within the landscapes they are located and key considerations in terms of their functional performance including durability, maintenance, and sustainability.

1.1.1.6 The intention of the pattern book is to provide a live document that can be:

- Used by designers of ANS;
- Used to communicate ANS design approach to stakeholders as part of engagement and planning activities;
- Updated in response to design development, research findings from Orsted ANS once installed or third party ANS research findings; and
- Shared with the wider public to communicate ANS design approach and Orsted's commitment to high quality environmental design.

1.1.1.7 Further information, including the ecological principles that have informed the design of all ANS in the East Anglia and North East zones, is contained within the pattern book (**Appendix 1**).

1.1.1.8 All ANS are being designed to provide capacity for an assumed minimum of 467 nesting pairs of kittiwake per ANS. The different ANS designs may provide a greater number of nesting spaces (more than 467 nesting spaces) according to the dimensions and practical fit of the number of ledges on each structure design.

1.1.1.9 As well as ongoing engagement with NIRAS and the OOEG to principally address the ecological design of the ANS, extensive engagement has also taken place with a range of local stakeholders. For example, in relation to the Old Yacht Club site, consultation took place with Hartlepool Borough Council (planning department, flood risk team, ecology department, environmental health department and landscape department) and Tees Archaeology. Consultation letters were sent to local ward councillors, parish councils and neighbouring businesses. Leaflets were posted to local residents and information was made available via the Hornsea Three website.

1.1.1.10 For the nearshore locations, consultation has been undertaken with local planning authorities ([redacted], East Suffolk Council), local port authorities (Associated British Ports and [redacted]) and [redacted] in addition to site-specific stakeholders (e.g. local infrastructure owners, local RSPB, Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB) Partnership and National Trust). The Maritime and Coastguard Agency (MCA), Trinity House, Historic England, National Federation of Fishermen's Organisations (NFFO) and Eastern Association of Inshore Fisheries and Conservation Authorities (IFCA) have also been consulted.

1.1.1.11 Engagement with the Local Planning Authorities and other stakeholders was critical to understand the site-specific planning related considerations, requirements, deliverables, and to take on board considerations of the local community, in order to achieve a comprehensive and well considered Planning Application or Marine Licence Application for all ANS sites.

2 Nearshore ANS Design Proposals

2.1 Design Approach

2.1.1.1 The ANS takes an octagonal form to provide multiple aspects to enhance ecological performance. In addition, it has sides that align to the 4 cardinal and 4 ordinal points of the compass to assist scientific observations and is a design that is not overly complex (for reasons of buildability).

2.1.1.2 Seven elevations of the ANS contain nesting spaces with the blank eighth elevation incorporated for construction and maintenance reasons. Where possible, the blank elevation is orientated to face the direction of the least preferred nesting direction by birds, whether that is the one of the sunniest directions and/or the prevailing wind direction during the kittiwake nesting season, so providing the maximum amount of sheltered nesting space preferred by nesting birds.

2.1.1.3 All nesting elevations of the ANS will be formed as individual nesting compartments, grouped nests in 2s and/or 3s and some open ledges to maximise shelter provided from sun and wind for nesting birds as well as providing diversity so nesting preferences can be observed during annual

monitoring. Whilst a more sheltered aspect may be preferred for nesting, birds still do nest in more exposed conditions, as concluded through NIRAS's UK field observations that recorded kittiwake nesting on all aspects of the Sizewell A rigs. The octagonal form of the ANS provides a variety of nesting conditions and with carefully considered massing, detailing, materiality, and an appropriate contextual fit is achieved in consideration of views from land.

2.1.1.4 The ANS has an ecologically driven design as well as a design that is responsive to the particular characteristics of the site and context to create a successful structure for nesting kittiwake as well as an appropriate fit within the landscape / seascape setting. Due regard for all operational practicalities has also been made to ensure the ANS is both efficient and safe to access and maintain.

2.2 Contextual Design

2.2.1.1 Consideration has been given to the appropriateness of the design with regard to its coastal context. In the case of the locations along the Suffolk Coast the design is contextualised in character as part of the enigmatic military structures[1], energy and coastal defence infrastructure and busy coastal towns (including piers, recreational and leisure facilities, and art works), as well as areas of more remote rural character of its coastline. The ANS has been conceived as an extension of this unique collection of functional and enigmatic structures that are characteristic of the place and so creating an appropriate fit into the distinct 'unusualness' of the area.

2.3 Key features

- The ANS is an independent marine structure comprising of an octagonal ANS topside supported above the water on a single monopile;
- Capacity for a total of approximately 504 nesting spaces[2] with 72 on each of the 7 nesting elevations, all comprising 8 rows of ledges and 9 nesting compartments on each row. One elevation of the octagon includes no nesting space or ledges. Specific numbers of nesting spaces are subject to change depending on the final detailed designs for each location;
- Nesting spaces are incorporated on 7 of the 8 elevations of the ANS. Typical dimensions of the nesting compartments are 0.4m width x 0.4m height x 0.2m depth, noting specific dimensions are subject to change depending on the final detailed designs for each location;
- The lowest nesting spaces are located at a safe height of approximately 3.0m above Highest Astronomical Tides (HAT), 6.0m above projected HAT when accounting for sea level rise over 40 years, which is the minimum life requirement for the ANS, and 1.88m above the highest predicted wave with a probability of 1 in 200 years or 0.5% per year;
- Avian predator mitigation is provided primarily through the 0.2m depth nesting ledge dimensions and the 0.2m minimum overhang provided by the ANS roof above the highest nesting ledges. The overhangs mean the shelves will not be visible from the roof and are likely to prevent predators from swooping towards the nests. Further, the ANS roof pitch is in excess of 25 degrees to discourage nesting by any birds. Given the ANS location and mitigation inherent to the design, it is not anticipated that the ANS will be susceptible to avian predation issues. However, should any issues arise in operation, the situation will be reviewed by ornithologists and appropriate action identified;
- Nesting ledges are arranged with slight overhangs to help avoid droppings landing on nesting ledges below;
- Due to the marine location, ground predators are not anticipated to be an issue. The ANS is however located a significant distance above water level at approximately 3.0m above HAT with a significant overhang between the central access point under the ANS and outer extent of the lowest nesting ledges;

[1] https://www.suffolkcoastandheaths.org/wp-content/uploads/2022/05/A-Map-of-Mystery-April-2022.pdf
[2] The required minimum provision for each ANS was set at 467 nests. This number was rounded up to 500 to include contingency for the purposes of the design process and to avoid falling below the required minimum. The final design due to its geometry and size resulted in 504 nests as the closest matching quantity of nests.

- The ANS is equipped with operable nest panels accessible from the inside of the structure. For health and safety reasons access has been limited to the lower shelves with the highest ones permanently fixed;
- The ANS is predominantly a steel structure mounted on a central monopile support. Most parts are finished with highly durable paint systems typically used for harsh offshore maritime conditions to ensure corrosion protection, durability, aesthetic performance, contextual fit and low maintenance requirements over time;
- The ANS is accessed by water as described in the access section; and
- The ANS will require navigational aids and internal safety lighting that can be solar powered. These requirements are being finalised in consultation with the MCA and Trinity House.

2.4 Colours

2.4.1.1 The nearshore ANS's colour scheme has been developed to response to its marine context in terms of navigational safety, seascape integration and longevity in a harsh environment. In consultation with the local port authority, MCA and Trinity House, a yellow colour for the pile was established to increase visibility for marine traffic in all weather conditions. The paint used will be protective as a coat but to aid further in increased protection of the structure a light grey, close to white, was chosen for the topside (the part of the ANS above the pile) to reflect as much UV radiation as possible while visually integrating the structure in its marine environment by blending in with the sea and the sky. The colour was chosen following stakeholder consultation for which a range of extensive studies were undertaken to define the overall direction and then distil the selection to the precise tone.

2.5 Access

2.5.1.1 The ANS will be located beyond the low water mark and accessible by water only. Access to the ANS will be for occasional monitoring and access of nests from the interior as well as maintenance by appropriately qualified and trained personnel. The central monopile that supports the ANS will incorporate a vessel docking and ladder arrangement to accommodate the safe transfer of authorised and trained personnel and equipment for the undertaking of any scheduled and reactive maintenance required.

2.5.1.2 Access to and from the structure shall be designed in compliance with industry standards; the safe transfer of equipment and materials shall also be taken into consideration. Most ecological monitoring would be carried out from a vessel, primarily for reasons of health and safety and associated practicalities for ornithologists carrying out the monitoring operations. The ANS has been designed to ensure viewing angles from a vessel would allow suitable visual access to all nesting space on all ANS elevations (using binoculars) to carry out the required monitoring operations. Monitoring of nesting space can also be carried out by drone.

2.5.1.3 Unauthorised human access is mitigated firstly due to the visually open location of the ANS beyond the low water mark and secondly with access to the ANS interior restricted to a locked cage facilitating safe use of the ladder whilst restricting access to the interior of the structure. Access to the ANS exterior and nesting elevations is mitigated due to the height of the ANS above water and the significant horizontal overhang between the centrally located access ladder underneath the ANS and the outer faces of the ANS.

2.5.1.4 Emergency evacuation of personnel and potential casualties has been considered in the design and layout of the ANS. The non-nesting side of the ANS is fitted with an operable aperture through which equipment and casualties can be transferred to and from vessels. The use of a portable Davit Arm Jib Crane could be employed in such scenarios being brought onto the structure when needed and removed after use.

2.6 Stakeholder Design Advice

2.6.1.1 The following advice has been received from OOEG members during technical panel meetings and designs have been updated accordingly:

- Consideration of shelter and aspect in the design; in particular, solar and wind;
- For Lowestoft location: Consideration of the ANS response to the pier / town / seafront / seascape context;
- For the Minsmere location: Consideration of views to the horizon and their potential interruption by the ANS in an AONB setting;
- Consideration of potential prevention of unauthorised access to the ANS;
- Consideration of whether ANS colour will influence kittiwake use of the ANS; and
- Consideration of potential internal access to the ANS for additional monitoring activities (e.g. colour ringing) and a clear health and safety rationale for the remote monitoring proposed.

2.6.1.2 During a consultation meeting held on 21/01/22, the National Trust noted hues of grey may be preferable to white. During a consultation meeting held on 03/02/22 with the Suffolk Coast and Heaths AONB, RSPB and the National Trust, it was noted that the Proposed Development is more linked to the maritime environment than the land. A colour preference for lighter greys or sand was stated. A study on lighter greys and sand tones were investigated with the lighter greys found to be better suited to the marine environment.

2.7 Drawings

2.7.1.1 Design drawings are presented in **Appendix 2**. Note, exact dimensions are specific to each location and subject to change.

3 Onshore ANS Design Proposals

3.1 Design Approach

3.1.1.1 The two onshore ANS typologies have been designed with the Old Hartlepool Yacht Club site in mind. They are both ecologically driven designs that are also responsive to the particular characteristics of the site and context to create successful structures for nesting kittiwakes as well as an appropriate fit within their landscape setting. The site-specific ecological strategy for kittiwake is to locate nesting spaces facing the existing kittiwake colonies on the walkway to the lifeboat pontoon and within Headland and Victoria Harbour, as well as providing nesting spaces that capitalise on sea views.

3.1.2 ANS Hut Typology

3.1.2.1 The first onshore ANS typology takes inspiration from the fishermen's huts that can be seen locally as well as historically within the Old Hartlepool Yacht Club site itself. Fishermen's huts can often be found in coastal communities, and as such provide a good local archetype upon which to build a site-specific concept for one of the ANS. The ANS huts are arranged along the northeast edge of the site facing towards the existing kittiwake colony. Key features of the hut ANS typology include:

- Capacity for a total of 534 preferred nesting spaces (i.e. facing the sea);
- Nesting spaces incorporated along the seaward facing elevations of the huts. Typical dimensions of each nesting compartment are 0.4m width x 0.4m height x 0.2m depth;
- Avian predator mitigation is provided primarily through the 0.2m depth nesting ledge dimensions and the 0.2m minimum overhang provided by ANS roofs above the highest nesting ledges, as advised and agreed by the OOEG. Given the ANS locations and mitigation inherent to the design, it is not anticipated that the ANS will be susceptible to avian predation issues. However, should any issues arise in operation, appropriate action can be taken to mitigate the

particular predation issue. For instance, if corvids or large gulls are seen to be using structures on / in the vicinity of the ANS as perches from which to launch predatory attacks on nesting birds, additional deterrents such as wires or spikes would be added to these structures. If monitoring revealed predation was still an issue, and specialist individuals could be identified, where appropriate, control measures would be sought under licence from the relevant authorities, though non-lethal control methods will be explored in the first instance;

- Hut roof pitch is in excess of 25 degrees to discourage nesting of all birds;
- Nesting ledges are arranged with slight overhangs to help avoid droppings landing on nesting ledges below;
- The huts are located with 0.6m deep overhangs below the lowest nesting ledges along all nesting faces to mitigate against ground predators, as advised and agreed by the OOEG;
- In combination with the huts' lowest nesting ledge 0.6m overhangs, there is a continuous concrete wall beneath that forms a smooth vertical face in excess of 2.0m height to mitigate against ground predators. The concrete walls are sand colour to match the adjacent sandy beach;
- Nesting ledges have been designed for adaptability to allow all ledges to be changed to be fully partitioned into 0.4m width compartments, contain no compartments or any combination in between;
- The huts provide a sheltered environment for ornithological monitoring operations where kittiwake will not be able to see those conducting the monitoring operations;
- Within the huts, most nesting spaces can be accessed physically and individually for monitoring purposes, such as ringing, using a sliding access panel system. A transparent panel system that includes opaque and one-way film elements provides visibility of most nesting spaces from within the huts without disturbing the birds;
- CCTV is mounted within columns set back from the hut nesting faces to allow remote monitoring for research and security purposes;
- CCTV is included elsewhere in the site within columns at key locations for security, mitigating unauthorised human access;
- The Old Yacht Club site will have a 1.8m height weldmesh perimeter fence around its periphery, on-site CCTV security system and locked access gates as part of the site security measures which will mitigate unauthorised human access;
- The huts are timber clad structures on galvanised steel frames. Timber will weather to a natural grey colour providing a low maintenance material with good thermal properties that fits contextually. Nesting ledges and compartments are formed using folded steel sheet to help provide acceptable durability, longevity, and maintenance performance. Steel components and some cementitious panels, which are used in difficult to maintain areas instead of timber, will have a matt grey or galvanised / powder coated finish to match weathered timber cladding on the ANS;
- Huts have access doors on the landward sides;
- Huts are supplied with power and internal lighting; and
- Access to huts for maintenance activities is by cherry picker from level space created within the site, adjacent to landward and seaward hut elevations for any exterior maintenance operations required.

3.1.3 ANS Tower Typology

3.1.3.1 The second onshore ANS takes inspiration from the various tower typologies that can be found in the locality. The ANS has been designed as a ten-sided decagon, whereby multiple external faces provide a variety of nesting aspects, and the structure forms an internal space that allows sheltered working conditions for those involved in ecological monitoring operations. The tower

ANS is located west of the ANS huts to provide good sea views. Key features of the tower ANS typology include:

- Capacity for a total of 510 preferred nesting spaces (i.e. seaward facing) and 340 non-preferred (i.e. landward facing) nesting spaces (assuming 6 faces of the tower are counted as preferred faces);
- Nesting space is incorporated on all 10 faces of the tower. Typical dimensions of each nesting compartment are 0.4m width x 0.4m height x 0.2m depth;
- Avian predator mitigation is provided primarily through the 0.2m depth nesting ledge dimensions and the 0.2m minimum overhang provided by ANS tower roof above the highest nesting ledges. Given the ANS location and mitigation inherent to the design, it is not anticipated that the ANS will be susceptible to avian predation issues. However, should any issues arise in operation, appropriate action can be taken to mitigate the particular predation issue in consultation with the OOEG;
- Tower roof pitch is in excess of 25 degrees to discourage nesting by any birds;
- Nesting ledges are arranged with slight overhangs to help avoid droppings landing on nesting ledges below;
- The lowest nesting ledges have a 0.6m deep overhang (as advised and agreed by the OOEG) over the vertical faces that forms the base of the tower;
- In combination with the 0.6m nesting ledge overhang, the vertical faces that form the base of the tower provide clear, smooth surfaces in excess of 2.0m height to mitigate against ground predators;
- Nesting ledges have been designed for adaptability to allow all ledges to be changed to be fully partitioned into 0.4m width compartments, contain no compartments or any combination in between;
- The tower provides a sheltered environment for ornithological monitoring operations where kittiwakes will not be able to see those conducting the monitoring operations;
- Within the tower, most nesting spaces can be accessed physically and individually for monitoring purposes, such as ringing, using a sliding access panel system. A transparent panel system that includes opaque and one-way film elements provides visibility of most nesting spaces from within the huts without disturbing the birds;
- CCTV is mounted within columns set back from the tower faces to allow remote monitoring for research and security purposes, mitigating unauthorised human access;
- CCTV is included elsewhere in the site within columns at key locations for security;
- The tower is a timber clad structure on a galvanised steel frame. Timber will weather to a natural grey colour providing a low maintenance material with good thermal properties that fits contextually. Nesting ledges and compartments are formed using folded steel sheet to help provide acceptable durability, longevity, and maintenance performance. Steel components and some cementitious panels, which are used in difficult to maintain areas instead of timber, will have a matt grey or galvanised / powder coated finish to match weathered timber cladding on the ANS;
- The tower has an access door on the landward side at the base of the structure. The tower is naturally ventilated;
- The tower is supplied with power and internal lighting; and
- Access to the tower for maintenance activities is by cherry picker from level space created within the site around its base for any exterior maintenance operations required.

3.1.3.2 Both tower and huts are served by paths that provide accessible level access to them for people or occasional maintenance equipment.

3.2 Site Specific OOEG Design Advice

3.2.1.1 The following advice has been received from OOEG members during technical panel meetings and designs have been updated accordingly:

- 2.0m height minimum from lowest nesting ledge for ground predator mitigation;
- Requirement for smooth faces to any walls that provide ground predator mitigation to help stop climbing;
- Confirmation of a 0.6m recessed overhang required beneath lowest nesting ledges;
- Confirmation that grass or plants that do not provide potential footholds for ground predators can be used at the foot of the vertical faces that provide ground predator mitigation; and
- For the tower ANS it would be good for experimental design to have nesting ledges on all sides (landward and seaward facing) – interesting for futureproofing and to observe what kittiwake want and like and where they chose to nest.

3.3 Drawings

3.3.1.1 Design drawings are presented in **Appendix 2**. Note, exact dimensions are specific to each location and subject to change.