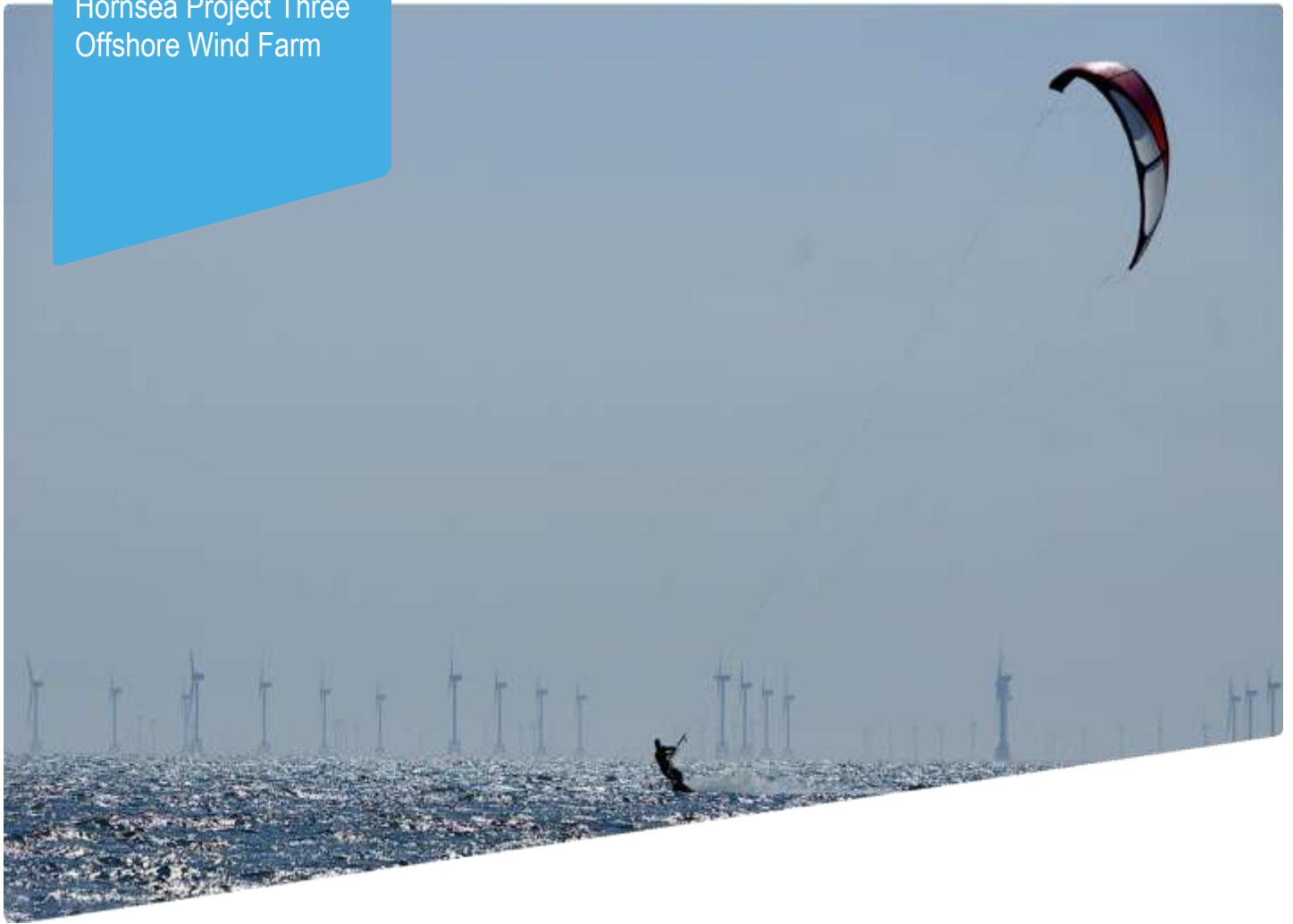


Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three Offshore Wind Farm

Appendix 5 to Deadline 4 submission - Design Objectives and Principles for the HVDC Converter/HVAC Substation and HVAC Booster Station Buildings

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Ørsted

5 Howick Place,

London, SW1P 1WG

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Acronyms

Acronym	Description
AONB	Area of Outstanding Natural Beauty
DCO	Development Consent Order
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
LCA	Landscape Character Areas
NNDC	North Norfolk District Council
NSBLPZ	Norwich Southern Bypass Landscape Protection Zone
SNC	South Norfolk Council
SPD	Supplementary Planning Document

1. Introduction

- 1.1 This document sets out the policy requirements and the design objectives and principles which will underpin the visual appearance of the onshore HVDC converter/HVAC substation and onshore HVAC booster station buildings proposed as part of the Hornsea Project Three Offshore Wind Farm (hereafter referred to as 'Hornsea Three').
- 1.2 The design objectives and principles set out in Appendix A ("the Design Objectives and Principles") will be applied when developing the detailed design for the aesthetics of the buildings of the onshore HVDC converter/HVAC substation and onshore HVAC booster station. This document includes a range of illustrations from similar developments to provide design context. Should the Development Consent Order (DCO) be consented, Requirement 7 'Detailed Design approval onshore' of the Draft DCO (REP1-127) requires that work must not commence until details of the layout, scale and external appearance of the work, which must be substantially in accordance with the Design Objectives and Principles, have been submitted to and approved by the relevant local authority.
- 1.3 The location of the onshore HVDC converter/HVAC substation and onshore HVAC booster station is shown in Figure 3.35 and 3.33 of Volume 1, Chapter 3: Project Description of the Environmental Statement (APP-058) respectively.
- 1.4 An indicative layout of an onshore HVDC converter/HVAC substation for Hornsea Three was developed for the purpose of informing the photomontages presented in Volume 6, Annex 4.5: Photograph Panels, Wirelines and Photomontages of the Environmental Statement (APP-146) and Annex 5.7: Historic Environment Visualisations (APP-155). However, maximum design parameters were used for the purpose of informing the wireframes, also presented in APP-146 and APP-155, which informed the assessment of landscape and visual, and historic environment impacts. It is the maximum design parameters which have also been used to inform the design objectives and principles within this document.
- 1.5 This document considers the design of the buildings associated with the onshore HVDC converter/HVAC substation and HVAC booster station only and therefore does not consider the design of landscaping, which is described in the Outline Landscape Management Plan (Appendix 4, Version 2 submitted for Deadline 4), which accompanied the DCO application and is considered a live document to be updated throughout examination. However, the interaction between the design objectives and principles of the buildings and the Landscape Management Plan is set out in the Design Objectives and Principles.

Onshore HVDC converter/HVAC substation

- 1.6 Detailed design of Hornsea Three has not yet been undertaken and as such there are a variety of technical details which remain uncertain, for example the use of HVDC or HVAC, each of which will determine the size, layout and shape of the onshore HVDC converter/HVAC substation (although all scenarios would remain within the parameters as set out in the Onshore Limits of Deviation [APP-026]). As a result of this uncertainty, the design of the onshore HVDC converter/HVAC substation has been designed to facilitate a variety of voltage levels, different electrical configurations (monopoly or bipolar), different suppliers and different technologies (HVAC and HVDC).

- 1.7 However, as set out in paragraphs 3.7.6.2 and 3.7.6.3 of Volume 1, Chapter 3: Project Description of the Environmental Statement (APP-058), the onshore HVDC converter/HVAC substation will comprise a compound, containing equipment required to switch and transform electricity received from the wind farm to the voltage level for grid connection and to provide reactive power compensation, or containing equipment to convert HVDC electricity to HVAC electricity, and housing auxiliary equipment and facilities for operating, maintaining, controlling the substation and to access the compound by vehicles and trucks.
- 1.8 The main equipment at the onshore HVDC converter/HVAC substation will either be housed within a single or multiple buildings, in an open yard or a combination of the above. If multiple buildings are used the length and width of these buildings would be reduced proportionally to the number of buildings (e.g. if two buildings were used they would each cover approximately half of the area required for the single larger building). There may also be some smaller buildings required to house components such as smaller equipment and control rooms. In respect to HVAC and HVDC technologies, one of the main physical differences in the equipment is that the HVAC components housed within buildings are normally compact, gas insulated switchgear (GIS). In the case of HVDC, gas insulated systems are not available, therefore the main, indoor HV components (specifically the power electronics valves responsible for conversion from HVDC to HVAC power) must be air insulated. This necessitates large air clearances between the valve stacks and building structures which typically drive the largest dimensions of the buildings. These clearances, as well as the height of the valve stacks themselves, are dependent upon the voltage of the HVDC system, with higher system voltages resulting in taller valve stacks and larger internal air clearances.
- 1.9 The maximum design parameters for the onshore HVDC converter/HVAC substation for both HVAC and HVDC options are presented in Table 3.63 of Volume 1, Chapter 3: Project Description of the Environmental Statement (APP-058).
- 1.10 The substation design must meet the requirements of The Electricity Safety, Quality and Continuity Regulations 2002, Part III, Regulation 11: Substation Safety which states *“Every generator and distributor shall, for every substation which he owns or operates—*

- a) *enclose the substation where necessary to prevent, so far as is reasonably practicable, danger or unauthorised access;*
- b) *enclose any part of the substation, which is open to the air and contains live equipment which is not encased, with a fence or wall not less than 2.4 metres in height to prevent, so far as is reasonably practicable, danger or unauthorised access;*
- c) *ensure that, so far as is reasonably practicable, there are at all times displayed—*
 - i. *sufficient safety signs which comply with Schedule 1 and which are of such size and placed in such positions as are necessary to give due warning of such danger as is reasonably foreseeable in the circumstances;*
 - ii. *a notice which is placed in a conspicuous position and which gives the location or identification of the substation, the name of each generator or distributor who owns or operates the substation equipment making up the substation and the telephone number where a suitably qualified person appointed for this purpose by the generator or distributor will be in constant attendance; and*
 - iii. *such other signs, which are of such size and placed in such positions, as are necessary to give due warning of danger having regard to the siting of, the nature of, and the measures taken to ensure the physical security of, the substation equipment; and*
- d) *take all reasonable precautions to minimise the risk of fire associated with the equipment.”*

1.11 In order to comply with the above requirements, the onshore HVDC converter/HVAC substation area will be enclosed by a 2.4 m high palisade fence with a 4 m high electrified pulse security fence installed on the internal side of the palisade fence. Fire walls will be used as required, in line with the maximum heights set out in Table 1.1 above, and appropriate signage installed. Internal surfaced roads will be required to access the buildings, for maintenance and car parking.

Onshore HVAC booster station

1.12 Detailed design of Hornsea Three has not yet been undertaken and as such there are a variety of technical details which remain uncertain, for example the voltage levels, each of which will determine the size, layout and shape of the onshore HVAC booster station (although all scenarios would remain within the parameters as set out in the Onshore Limits of Deviation [APP-026]). As a result of this uncertainty, the design of the onshore HVAC booster station has been designed to facilitate a variety of voltage levels, different electrical configurations (monopoly or bipolar) and different suppliers.

1.13 However, as set out in paragraph 3.7.5.2 and 3.7.5.4 of Volume 1, Chapter 3: Project Description of the Environmental Statement (APP-058), the onshore HVAC booster station will comprise of high voltage electrical reactors to correct the power factor of the transmitted electricity, as well as switchgear that connect the reactors into the export cable circuits. It will also contain auxiliary equipment for running and controlling the onshore HVAC booster station, as well as structures to support and house the equipment.

- 1.14 The main equipment at the onshore HVAC booster station will either be housed within a single or multiple buildings, in an open yard or a combination of the above. There may also be some smaller buildings required to house components such as smaller equipment and control rooms. An underground area providing access for the onshore export cables to enter the onshore HVAC booster station is also included in the design.
- 1.15 The maximum design parameters for the onshore HVAC booster station for the HVAC transmission scenario are presented in Table 3.62 of Volume 1, Chapter 3: Project Description of the Environmental Statement (APP-058).

2. Planning Policy Context

- 2.1 In order to identify appropriate design objectives and principles for the buildings proposed as part of the onshore HVDC converter/HVAC substation and onshore HVAC booster station, national and local planning policy, landscape guidance and design guidance documents were considered.

Policy

Overarching National Policy Statement for Energy (EN-1)

- 2.2 Section 4.5 of NPS EN-1 sets out 'Criteria for "good design" for energy infrastructure'.
- 2.3 The extent to which energy infrastructure development can contribute to improving the character and quality of an area is limited, as recognised by NPS-EN1 which states in paragraph 4.5.1, *"It is acknowledged, however that the nature of much energy infrastructure development will often limit the extent to which it can contribute to the enhancement of the quality of the area."*
- 2.4 EN-1 acknowledges that the visual appearance of a building is sometimes considered to be the most important factor in good design, but notes that high quality and inclusive design also includes the functionality of an object, including fitness for purpose and sustainability. As such, paragraph 4.5.3 of EN-1 states that the, *"[Secretary of State] should satisfy itself that the applicant has taken into account both functionality (including fitness for purpose and sustainability) and aesthetics (including its contribution to the quality of the area in which it would be located) as far as possible. Whilst the applicant may not have any or very limited choice in the physical appearance of some energy infrastructure, there may be opportunities for the applicant to demonstrate good design in terms of siting relative to existing landscape character, landform and vegetation. Furthermore, the design and sensitive use of materials in any associated development such as electricity substations will assist in ensuring that such development contributes to the quality of the area."*

National Policy Statement for Renewable Energy Infrastructure (EN-3)

- 2.5 Section 2.4 of NPS EN-3 sets out 'Criteria for "good design" for energy infrastructure'.
- 2.6 Paragraph 2.4.2 states, *"Proposals for renewable energy infrastructure should demonstrate good design in respect of landscape and visual amenity, and in the design of the project to mitigate impacts such as noise and effects on ecology."*

National Planning Policy Framework 2018 (NPPF)

- 2.7 Section 12 (paragraphs 124-132) of the NPPF sets out national policy in relation to "Achieving well-designed places". The policy is written in a way that makes clear that it is primarily intended to relate to the design of buildings and places such as new areas of commercial or residential development and, as a result, some aspects of the policy are not directly applicable to Hornsea Three.
- 2.8 The following policies are considered of relevance to the visual appearance of buildings associated with Hornsea Three:

- Policy 124: “... Good design is a key aspect of sustainable development, creates better places in which to live and work and helps make development acceptable to communities.”
- Policy 127: “Planning policies and decisions should aim to ensure that developments
 - a. will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development;
 - b. are visually attractive as a result of good architecture, layout and appropriate and effective landscaping; and
 - c. are sympathetic to local character and history, including the surrounding built environment and landscape setting, while not preventing or discouraging appropriate innovation or change (such as increased densities);”
- Policy 128: “Design quality should be considered throughout the evolution and assessment of individual proposals... Applicants should work closely with those affected by their proposals to evolve designs that take account of the views of the community. Applications that can demonstrate early, proactive and effective engagement with the community should be looked on more favourably than those that cannot”.

National Planning Practice Guidance

2.9

The ‘Design’ section of the Planning Practice Guidance sets out national guidance. Some aspects of the policy are not directly applicable to Hornsea Three as they relate to other forms of development, or only to plan-making processes, and others reiterate points covered by the NPPF without elaboration. The following extracts are considered of relevance to the visual appearance of buildings associated with Hornsea Three:

- Paragraph 1: “Achieving good design is about creating places, buildings, or spaces that work well for everyone, look good, last well, and will adapt to the needs of future generations.”
- Paragraph 2: “Good design should:
 - a. ensure that development can deliver a wide range of planning objectives;
 - b. enhance the quality buildings and spaces, by considering amongst other things form and function; efficiency and effectiveness and their impact on well being; and
 - c. address the need for different uses sympathetically.
- Paragraph 7:
 - a. “Development should seek to promote character in townscape and landscape by responding to and reinforcing locally distinctive patterns of development, local man-made and natural heritage and culture, while not preventing or discouraging appropriate innovation;
 - b. Local building forms and details contribute to the distinctive qualities of a place. These can be successfully interpreted in new development without necessarily restricting the scope of the designer. Standard solutions rarely create a distinctive identity or make best use of a particular site. The use of local materials, building methods and details can be an important factor in enhancing local distinctiveness when used in evolutionary local

design, and can also be used in more contemporary design. However, innovative design should not be discouraged.

- c. *The opportunity for high quality hard and soft landscape design that helps to successfully integrate development into the wider environment should be carefully considered from the outset, to ensure it complements the architecture of the proposals and improves the overall quality of townscape or landscape. Good landscape design can help the natural surveillance of an area, creatively help differentiate public and private space and, where appropriate, enhance security.”*
- Paragraph 19: *“Design features such as the position and scale of entrances and circulation spaces, and the ability of the construction to be modified, can affect how easily buildings can adapt to new demands. Places that are easy and practical to manage well tend to be more resilient. For example, where maintenance and policing are supported by good access, natural surveillance and hard wearing, easy to repair, materials.”*
- Paragraph 20: *“Distinctiveness is what often makes a place special and valued. It relies on physical aspects such as:

 - *the local pattern of street blocks and plots;*
 - *building forms;*
 - *details and materials;*
 - *style and vernacular;*
 - *landform and gardens, parks, trees and plants; and*
 - *wildlife habitats and micro-climates.*
 - *Distinctiveness is not solely about the built environment – it also reflects an area’s function, history, culture and its potential need for change.”**
- Paragraph 28: *“Materials should be practical, durable, affordable and attractive. Choosing the right materials can greatly help new development to fit harmoniously with its surroundings. They may not have to match, but colour, texture, grain and reflectivity can all support harmony”.*

Joint Core Strategy for Broadland, Norwich and South Norfolk

- 2.10 Policy 2 of the Joint Core Strategy for Broadland, Norwich and South Norfolk (January 2014) promotes good design, with development proposals required to respect local distinctiveness including, as appropriate:

- The history of the city, towns and villages, maintaining strategic gaps;
- The landscape setting of settlements including the urban/rural transition and the treatment of 'gateways';
- The landscape character and historic environment; and
- The provision of landscaping and public art.

South Norfolk Place-Making Guide Supplementary Planning Document (SPD)

2.11 The purpose of the South Norfolk Place-Making Guide SPD is to promote and secure high quality design in new development within South Norfolk. The guide expands upon planning policies in the Joint Core Strategy, in particular Policy 2: Promoting good design. It identifies various guidance points relating to architectural quality of buildings, including:

- Where surrounding development has a strong pattern and character, new development should seek to pick up on the positive aspects of the environment and enhance them;
- The principles found within the surrounding buildings must be understood and related to the new development;
- Buildings must be constructed in durable materials that will last well and look good over time; and
- Generally, it is preferable to adopt a design approach that is simple rather than complex in form and elevation, with attention paid to the quality of materials.

South Norfolk Development Management Plan

2.12 Policy DM 3.8: Design Principles applying to all development of the South Norfolk Development Management Policies Document identifies specific requirements relating to the visual appearance and design of a development proposal. These include:

- (4)(b) – The development is created with high standards of design, building materials, finishes and landscaping reflecting the use of distinctive local building traditions, materials and heritage assets where relevant; or innovative contemporary design solutions reflecting local context and reinforcing or creating local distinctiveness.

2.13 Three attributes concerned with protecting the setting of Norwich and the openness of the A47 corridor are defined by South Norfolk Local Plan Policy DM4.6: The Norwich Southern Bypass Landscape Protection Zone (NSBLPZ); Key Views 'cones' and Undeveloped Approaches. The B1113 between Swardeston and Norwich, where it runs through the NSBLPZ, is an Undeveloped Approach, as are other roads approaching Norwich to the west and east.

North Norfolk Local Development Framework

2.14 Planning Policy Statement 1 states that '*Good design ensures attractive, usable, durable and adaptable places and is a key element in achieving sustainable development*'.

- 2.15 To provide further guidance on North Norfolk Core Strategy policies, in particular EN4 Design and EN6 Sustainable Construction and Energy Efficiency, as well as to raise the quality of design in the district, The Design Guide SPD was produced by NNDC. It covers a wide range of subject areas, from new housing estates to hanging signs, and from barn conversions to large retail supermarkets. It also recognises the contribution heritage makes in defining North Norfolk. Although the Design Guide SPD does not provide a definitive pattern book for new development, it was intended to stimulate thought on a range of issues which should be considered during the development process.
- 2.16 Section 4 of the Design Guide SPD focuses on new non-residential development. Although energy infrastructure is not specifically covered, elements of the commercial, large retail and agricultural sections have been considered. Key points relating to the design of buildings include:
- Buildings should be in scale with their environs and avoid unduly strident or obtrusive facing materials or cladding;
 - Buildings should seek to sit comfortably within the landscape, use natural materials and take advantage of any established screening;
 - Sites should be appropriately screened across its frontage and enlivened with hard and soft landscaping to avoid unbroken seas of tarmac;
 - Broad spans and shallow pitched roofs can sometimes be improved by dividing the building into several bays and spanning each bay with a double pitched roof; and
 - Coloured corrugated sheets and boarding offer the best cladding solutions, with the darker tones work best for roofs to reduce the apparent scale of a building.
- 2.17 The Design Guide SPD also provides guidance on the materials to be used within different landscape contexts of North Norfolk.

Other Guidance

Malvern Hills AONB: Guidance on the Selection and Use of Colour in Development

- 2.18 Although not geographical aligned with the onshore HVDC converter/HVAC substation or onshore HVAC booster station sites, the principles prepared for the Malvern Hills Area of Outstanding Natural Beauty have also been considered in the preparation of the Design Objectives Principles. This document was considered relevant, primarily in respect to the onshore HVAC booster station due to the proximity of this element to the North Norfolk Coast AONB (an area with a comparable designation to the Malvern Hills AONB), although the guidance relevant to building design was considered applicable to both locations.
- 2.19 The guidance relevant to building design includes:

- Careful consideration of the use of colour when selecting materials and finishes helps new development fit into the existing landscape, and in turn contribute to the local distinctiveness of the area;
- Colour should never be seen in isolation from its setting, selecting colours for building materials has to take account of the site context if good choices are to be made;
- Exterior colour design can range from effectively camouflaging or minimising the visual appearance of a utilitarian building to emphasising the specific qualities of a place through the architecture, expressed in colour, form and massing;
- As a general rule, matt integration colours will sit better in a rural context allowing for patterns of light and shade to animate surfaces;
- If the scale of a building looks too large for its setting, introducing another colour of a dark recessive nature will help to diminish the apparent scale of the building, by breaking up its massing;
- Colour and material choices also need to be informed by the background texture of the landscape setting; and
- All natural green inherent colours have some yellowness in them though this does vary with seasonality and land management. If a developer wishes to use green on a development, and for it to appear green at a distance, then a green with a higher degree of yellow will be needed.

Britain in View: Colour and the Landscape

- 2.20 In the absence of a comparable, more recent document, the guidance for the use of colour on built structures set out in 'Britain in View: Colour and the Landscape' (1984) has been considered. This guidance explains that the choice of colour should be as scientific as possible; personal preference and intuition should be limited; and that un-natural colours should be avoided where possible as they cause visual overstimulation.
- 2.21 Key considerations identified in the guidance include visual factors (light, distance and surface materials) as well as colour characteristics.

National Grid Company Substation and the Environment: Guidelines on Siting and Design

- 2.22 Although specific to National Grid assets and therefore not automatically applicable to Hornsea Three, consideration was also given to the design guidelines provided in the National Grid Company Substation and the Environment: Guidelines on Siting and Design during the preparation of the Design Objectives and Principles. These guidelines are useful as they refer to similar equipment to that required for the HVDC converter/HVAC substation and due to the proximity of the Norwich Main National Grid Substation to the south-east of the onshore HVDC converter/HVAC substation. The guidelines include recommendations such as:

- Use of lightweight narrow section materials for taller structures (i.e. over about 6 m in height);
- Commissioning exterior design and colours appropriate to the surroundings;
- Use of materials and colours for buildings, equipment and fencing which harmonise with local surroundings;
- Where possible avoid the use of prominent insulators by consideration of available colours appropriate to the background; and
- Where possible site buildings to act as visual screens for switchgear.

3. Local Context

3.1 In addition to the national and local planning policy, as set out in section 2, the existing design and landscape context of the local areas were also considered.

Onshore HVDC converter/HVAC substation

3.2 The following aspects of the receiving landscape at the onshore HVDC converter/HVAC substation have been considered in the preparation of the design objectives and principles:

- Existing land use;
- Landscape character;
- Historic Sensitivity;
- Local building materials and predominant colours; and
- Need/desire for a new focus point/feature.

3.3 Each aspect is considered in more detail below.

Existing land use

3.4 The existing site for the onshore HVDC converter/HVAC substation comprises a single field, used for arable farming, with field boundaries characterised by established hedgerows.

3.5 The A47 (one of the few trunk roads within Norfolk, with national speed limit and a wide carriageway) runs along the northern boundary, whilst the western boundary abuts the B1113 (a single carriageway). To the south and south west lies the remainder of the field, beyond which lies Mangreen Lane and the residential settlement of Swardeston. To the south east lies an area of field, beyond which lies a cluster of residential properties and Mangreen Lane. Further to the south east lies the existing Norwich Main substation.

Landscape character

3.6 Local landscape character baseline at the onshore HVDC converter/HVAC substation site is primarily defined by the South Norfolk District Landscape Character Assessment. Consideration is given to a number of Landscape Character Areas (LCAs) within the Environmental Statement (Volume 3, Chapter 4: Landscape and Visual Resources (Document A6.3.4)), but for the purpose of defining the Design Principles for the onshore HVDC converter/HVAC substation, focus was given to those in closest proximity to the onshore HVDC converter/HVAC substation where the onshore HVDC converter/HVAC substation was most likely to have a notable effect on the character of the areas. These are shown in Sheet 8 of Figure 4.3 of Volume 3, Chapter 4: Landscape and Visual Resources (APP-076) and comprise:

- B1 Tas Tributary Farmland; and
- C1 Yare Tributary Farmland with Parkland.

3.7 As noted in paragraph 2.1313 above, the onshore HVDC converter/HVAC substation site sits within the area defined by South Norfolk Local Plan Policy DM4.6: The Norwich Southern Bypass Landscape Protection Zone (NSBLPZ). The B1113 between Swardeston and Norwich, where it runs through the NSBLPZ, is an Undeveloped Approach, as are other roads approaching Norwich to the west and east. This has been taken into consideration in identify design objectives and principles for the onshore HVDC converter/HVAC substation.

Historic Sensitivity

3.8 There are a number of sensitive heritage assets in the area surrounding the onshore HVDC converter/HVAC substation where significant adverse effects have been predicted (see Volume 3, Chapter 5: Historic Environment of the Environmental Statement (APP-077)), or concerns raised by interested parties in their representations (see REP2-009). These include Gowthorpe Manor House (list entry number 1050515) and Barn c. 40 m west of Gowthorpe Manor House (list entry number 13566141), Mangreen Hall (list entry number 1366150), and Keswick Hall (list entry number 1306331).

Local building materials and predominant colours

3.9 A variety of building materials are used within South Norfolk and in the local area. Within the South Norfolk Place-Making Guide SPD, traditional materials such as facing brickwork, clay pantiles, red brickwork, cedar cladding, painted render and zinc roofing, are identified for residential development.

3.10 No specific guidance on design of non-residential buildings is provided within the Place-Making Guide SPD, although it is noted that mixed use developments should enrich the mix of uses in a local area, balanced with the desirability of reinforcing local character, which may depend in part upon a distinctive mix for that particular area. Site visits undertaken to the local area has identified that materials for non-residential properties include brick and coloured corrugated sheets (see Figure 3.1).





Figure 3.1: Examples of non-residential development in the local area of the HVDC converter/HVAC substation site.

Need/desire for new focus point/feature

- 3.11 During the consultation process for Hornsea Three, feedback has not identified a desire by the local community, or South Norfolk Council to create a new focus point or feature at the onshore HVDC converter/HVAC substation.

Onshore HVAC booster station

- 3.12 The following aspects of the receiving landscape at the onshore HVAC booster station have been considered in the preparation of the design objectives and principles:

- Existing land use;
- Landscape character;
- Historic Sensitivity;
- Local building materials and predominant colours; and
- Need/desire for a new focus point/feature.

- 3.13 Each aspect is considered in more detail below.

Existing land use

- 3.14 The existing site for the onshore HVAC booster station comprises a portion of a single field, used for arable farming, with field boundaries characterised by established hedgerows and woodland.
- 3.15 To the north, south and west lies the remainder of the field or neighbouring agricultural fields. To the east and north-east lies areas of woodland comprising the New Covert County Wildlife Site (CWS) and Barningham Green Plantation respectively. Further to the south east lies Keepers Cottage and Shrubbs Farm.

Landscape character

- 3.16 Local landscape character baseline at the onshore HVAC booster station site is primarily defined by the North Norfolk Landscape Character Assessment. Consideration is given to a number of LCAs within the Environmental Statement (Volume 3, Chapter 4: Landscape and Visual Resources), but for the purpose of defining the design objectives and principles for the onshore HVAC booster station, focus was given to those in closest proximity to the onshore HVAC booster station. These are shown in Sheet 2 and 3 of Figure 4.3 of Volume 3, Chapter 4: Landscape and Visual Resources (APP-076) and comprise:
- TF3: Hempstead, Bodham, Aylmerton and Wickmere Area; and
 - WP5: Plumstead and Barningham.

Historic Sensitivity

- 3.17 There are also a number of sensitive heritage assets in the area surrounding the onshore HVAC booster station, but none where significant adverse effects have been predicated (see Volume 3, Chapter 5: Historic Environment of the Environmental Statement (APP-077)), although several lie within a 10 km radius. The only sensitive asset identified within the Zone of Theoretical Visibility of the onshore HVAC booster station is Salle Park (List entry number 1170353).

Local building materials and predominant colours

- 3.18 A variety of building materials are used within North Norfolk and in the local area.
- 3.19 Within the North Norfolk Design Guide SPD, traditional materials are identified as predominantly red brick and flint area. However, the SPD notes that many other materials can be specified and used where a clear local precedent exists or where a particular design justifies it. No specific guidance on materials to be used in the design of non-residential buildings is provided within the Design Guide SPD, as such examples present in the local area have been identified, as shown in Figure 3.1.



Figure 3.1: Examples of building materials and colours in the local area of the onshore HVAC booster station site.

Need/desire for new focus point/feature

3.20 During the consultation process for Hornsea Three, feedback has not identified a desire by the local community, or the North Norfolk District Council to create a new focus point or feature at the onshore HVAC booster station.

4. Examples of similar installations

- 4.1 Examples of similar infrastructure installations are presented below to provide context to the development of design objectives and principles for the buildings of the onshore HVDC converter/HVAC substation and the onshore HVAC booster station. These are shown in Figure 4.1 to **Error! Reference source not found.**



Figure 4.1: Walney Extension Onshore Substation as constructed



Figure 4.2: Hornsea Project One Onshore Substation during construction

5. Implications on Sensitive Receptors

- 5.1 The design objectives and principles set out in Appendix A ("the Design Objectives and Principles") will be applied when developing the detailed design for the aesthetics of the buildings of the onshore HVDC converter/HVAC substation and onshore HVAC booster station. The implications in respect to the impact assessment for landscape and visual resources, and historic environment, is set out under the relevant heading below.

Landscape and Visual

- 5.2 The assessment of effects presented in Volume 3, Chapter 4: Landscape and Visual Resources of the Environmental Statement (APP-076) considers a maximum design scenario based on the maximum building envelope for the onshore HVDC converter/HVAC substation and onshore HVAC booster station and does not give detailed consideration of colour or materials. In reality, effects of the completed development are likely to be less than those assessed due to the articulation of the various buildings and equipment within the site, and the application of the design principles set out above.
- 5.3 At both the onshore HVDC converter/HVAC substation and onshore HVAC booster station, the use of a greater number of slightly smaller main buildings, would help minimise effects through breaking up the massing of the site and reducing apparent scale. Similarly, articulation of building facades, as opposed to the use of simple rectangular sheds, would provide greater visual interest and break up the mass, helping the buildings integrate into their surroundings. This principle would assist in minimising the perceived mass and scale of the site regardless of whether one or multiple buildings are proposed.
- 5.4 The landscape character of the onshore HVDC converter/HVAC substation site and wider host character areas typically contains arable fields and pasture with intermittent woodland, dense hedgerows and mature trees. Therefore, the use of colours and tones present in the surrounding landscape, or those which are slightly darker, will help the buildings recede into the landscape. For the onshore HVDC converter/HVAC substation buildings, appropriate colours would reflect those seen in the winter landscape including grey browns and grey greens to reference the surrounding fields and hedgerows; darker greys and deep umber/reds could also be used as accent colours to reference the clay brick and slate of nearby houses.
- 5.5 The landscape character of the onshore HVAC booster station site and wider host character areas typically contains arable fields and woodland, dense hedgerows and hedgerow trees. Therefore, the use of colours and tones present in the surrounding landscape, or those which are slightly darker, will help the buildings recede into the landscape. For the onshore HVAC booster station buildings, appropriate colours would reflect those seen in the winter landscape including grey browns and grey greens to reference the surrounding fields and hedgerows; darker greys and browns could also be used as accent colours to reference the corrugated roofs and cladding of nearby agricultural buildings.

Historic Environment

- 5.6 The assessment of effects presented in Volume 3, Chapter 5: Historic Environment (APP-077) of the Environmental Statement considers a maximum design scenario based on the maximum building envelope for both the onshore HVDC converter/HVAC substation and the onshore HVAC booster station.
- 5.7 Impacts on these designated assets arise from the massing and height based on the maximum design scenario of the onshore HVDC converter/HVAC substation and the onshore HVAC booster station and are therefore to a large extent visual in their nature. On this basis, design principles used to reduce landscape and visual impacts (including reducing the size of the buildings and their overall mass through the construction of several smaller buildings, thus allowing a degree of integration into the existing landscape, as well as the use of innovative colours reflecting the pallet of the surrounding landscape) would reduce impacts on the settings of designated assets. These principles would similarly reduce impacts on the overall historic landscape.
- 5.8 In practice, and as with landscape and visual impacts, the effect of the completed development on heritage assets and the wider historic landscape are likely to be less than those assessed due to the application of the design principles set out in paragraph **Error! Reference source not found.** above.

Appendix A: Design Objectives and Principles for onshore HVDC converter/HVAC substation and HVAC booster station buildings

- A.1 The extent to which energy infrastructure development can contribute to improving the character and quality of an area is limited, as recognised by NPS-EN1. Despite this, particular attention has been given to the design of the Hornsea Three in order to remove and minimise potentially adverse impacts and to seek to create a development which is sympathetic to its setting. Design measures adopted by Hornsea Three in relation to landscape character are set out in section 4.10 of Volume 3, Chapter 4 of the Environmental Statement. Additional details on landscape mitigation and enhancement are set out in the OLMP (Appendix 4, version 2 submitted at Deadline 4) and detailed design will commence post-consent, should the DCO be granted.
- A.2 This document sets out the design objectives and principles which have been identified for the buildings proposed as part of the onshore HVDC converter/HVAC substation and onshore HVAC booster station. The objectives and principles have been identified with due consideration to national and local planning policy and to the existing character of the local areas, as well as potential landscape, visual and heritage impacts.
- A.3 These principles and objectives will inform the final details of the buildings which will be developed under DCO Schedule 1, Part 3, Requirement 7 'Detailed Design approval onshore'. This requirement requires that work must not commence until details of the layout, scale and external appearance of the onshore HVDC converter/HVAC substation and HVAC booster station, which must be substantially in accordance with these Design Objectives and Principles, have been submitted to and approved by the relevant local authority.

Design objectives for buildings

- A.4 The key design objective for both the onshore HVDC converter/HVAC substation and onshore HVAC booster station buildings is to minimise the potential impact on sensitive receptors by seeking to integrate the buildings into the surrounding environment.
- A.5 The key sensitive receptors for the onshore HVDC converter/HVAC substation are considered to be historical assets (including Keswick Hall, Intwood Hall and Gowthorpe Manor); local landscape character; residential properties in the surrounding area; transient users of the area (including users of PRoW). The A47 Norwich Southern Bypass Landscape Protection Zone and the B1113 Undeveloped Approach are also an important factors to consider in relation to views from the A47 and the B1113.
- A.6 The key sensitive receptors for the onshore HVAC booster station are considered to be limited to transient users of the area (including PRoW) and local landscape character.

Design principles for buildings

- A.7 The functional relationship between the onshore HVDC converter/HVAC substation and the onshore export cable, as well as the Norwich main substation, will significantly contribute to the design and orientation of buildings and equipment. The same principle is applicable to the onshore HVAC booster station and the onshore export cable. As such, final site layout and detailing of buildings will be driven by the technical requirements of the equipment used, however a number of key design principles will be applied in order to seek the best possible design response (aesthetics) to the local context of the onshore HVAC booster station and onshore HVDC converter/HVAC substation.
- A.8 In this regard, Hornsea Three will develop the detailed design of the onshore HVDC converter/HVAC substation buildings and HVAC booster station buildings through implementation of the following design principles, with early consultation with SNC and NNDC respectively:
- Where possible, buildings will be orientated and articulated to minimise the perceived bulk and massing of the buildings particularly if multiple buildings are proposed; to act as visual screens for switchgear; and take advantage of existing and proposed landscape screening;
 - Exterior design and colours for the buildings will be appropriate to the surroundings, avoiding the use of reflective materials on building facades;
 - Buildings will be constructed in durable materials;
 - Exterior design of buildings will be simple rather than complex in form and elevation;
 - Exterior design and colours (including hue and tone) for the buildings will be identified based on established surrounding landscape and land use context;
 - Exterior colour design will seek to minimise the visual appearance of the building(s) as opposed to creating a design feature;
 - Where possible avoid the use of prominent insulators by consideration of available colours appropriate to the background;
 - Where feasible, seek to enclose electrical gear within a building;
 - Outdoor equipment should seek to retain as low a profile design, with low height structures and silhouettes, as possible;
 - Seek to make use of lightweight, narrow section materials for taller structures (especially for gantries over 6 m in height);
 - Space should be used effectively to limit the area required for development within the limits of deviation parameters established for the project; and
 - Design of access roads, perimeter fencing, earthshaping, planting and ancillary development should form an integral part of the site layout and design to fit in with the surroundings.
- A.9 It is noted that the design of outdoor equipment is typically fixed by its function and there is little that can be done to alter its appearance. In this regard, the external high voltage equipment is likely to be provided in grey.

- A.10 It is relevant to note that the design development for the onshore HVDC converter/HVAC substation and onshore HVAC booster station will be progressed in parallel to the detailed design of the landscape mitigation proposed around the perimeter of each component. In respect to the onshore HVDC converter/HVAC substation, this will enable the design and landscape mitigation to respond to each other, promote good design whilst also seeking to maintain the openness of the Norwich Southern Bypass Landscape Protection Zone as far as possible (REP1-223).
- A.11 Further details on the proposed landscaping at the onshore HVDC converter/HVAC substation and onshore HVAC booster station is provided in the Outline Landscape Management Plan (Appendix 4, Version 2 submitted for Deadline 4). The final landscape mitigation planting is to be approved under Requirement 8 of the draft DCO.

Lighting principles for buildings

- A.12 Details on permanent lighting for the onshore HVAC booster station and onshore HVDC converter/HVAC substation would similarly follow DCO consent (under Schedule 1, Part 3, Requirement 7 Detailed Design Approval Onshore). However, design principles for lighting have been established in order to minimise any potential effects whilst ensuring that Hornsea Three provides enough illumination to safely undertake required activities. These include:
- To design a strategy that will satisfy the fundamental demands for safety and security;
 - To design a strategy which optimises energy use through energy efficient luminaires, and dimmer and timed system;
 - To use lighting solutions which avoid over-lighting thus minimising light pollution;
 - To locate significant sources of lighting away from sensitive landscape and ecological receptors;
 - To use high performance luminaire with suitable light control to reduce light spill and glare;
 - To use light fixtures which are fully adjustable in height and location;
 - To use columns of a minimum height. When lighting large areas preference would be given to several lower-units rather than tall wide beam lighting units to limit light trespass, glare and sky glow;
 - To direct light to the area where it is needed to avoid reflectance from buildings and structures and to avoid illuminating building facades;
 - To switch off luminaires when not required for safety or security;
 - Use of similar or the same design of light fittings where possible;
 - Luminaires would be pointed towards the centre of the development boundary, and away from adjacent sensitive sites wherever possible; and
 - To use lux levels appropriate for what is required.

References

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Malvern Hills AONB Partnership (2016) *Guidance on the Selection and Use of Colour in Development*

North Norfolk District Council (2008) *Design Guide Supplementary Planning Document*

South Norfolk Council (2012) *South Norfolk Place-Making Guide Supplementary Planning Document*