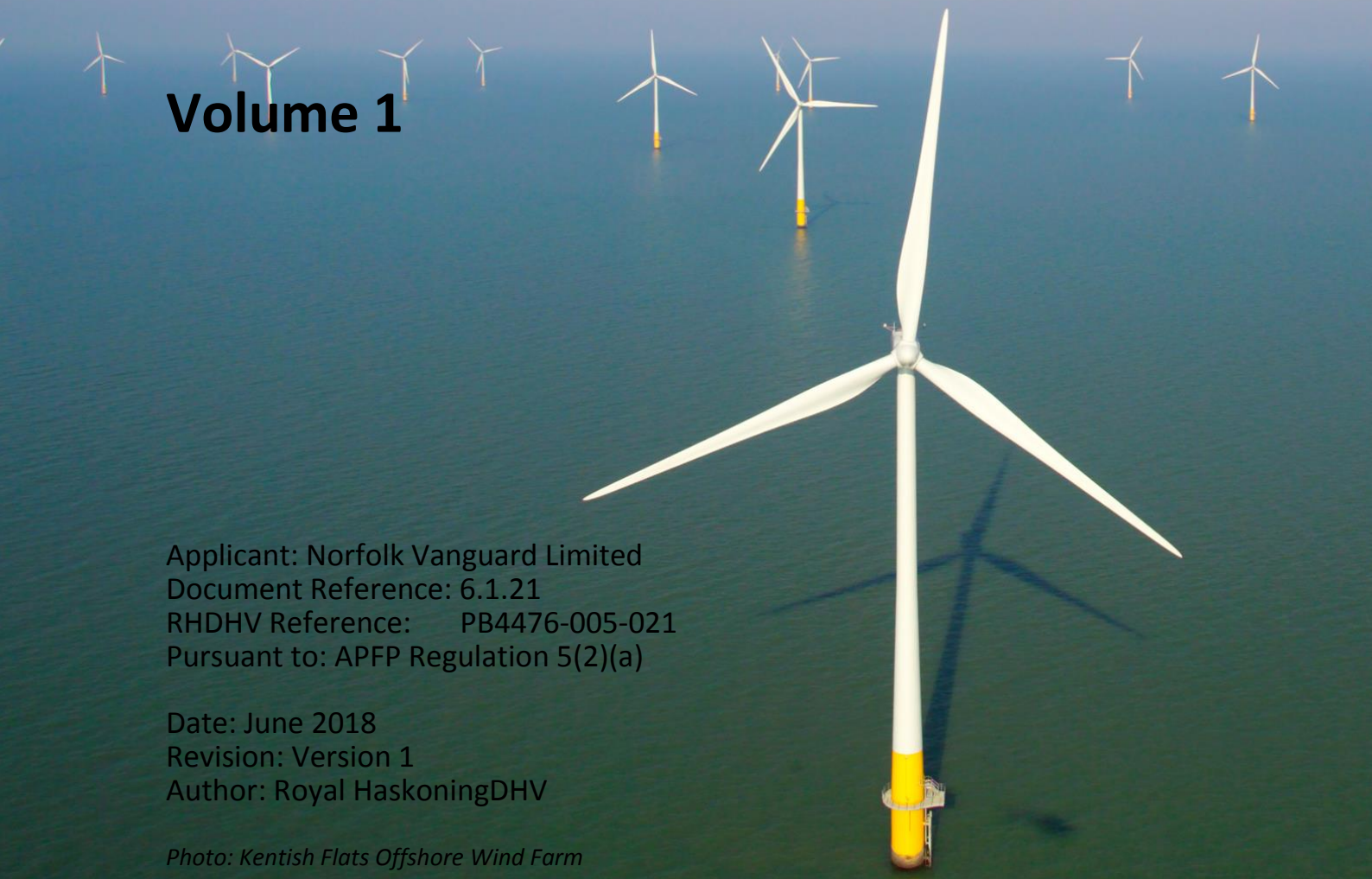
Norfolk Vanguard Offshore Wind Farm

Chapter 21

Land Use and Agriculture

Environmental Statement

Volume 1



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Environmental Impact Assessment
Environmental Statement

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For and on behalf of Norfolk Vanguard Limited

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Date: 8th June 2018

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Glossary

ALC	Agricultural Land Classification
ALO	Agricultural Liaison Officer
AC	Alternating Current
BMV	Best and most versatile
CRS	Cable relay station

CoCP	Code of Construction Practice
CEMP	Construction Environment Management Plan
CIA	Cumulative Impact Assessment
CPRE	Campaign for Rural England
CRoW	Countryside and Rights of Way Act 2000
DC	Direct Current
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
ELS	Entry Level Stewardship
EA	Environment Agency
EIA	Environmental Impact Assessment
ES	Environmental Statement
ESS	Environmental Stewardship Scheme
ha	Hectares
Hz	Hertz
HDD	Horizontal Directional Drilling
HLS	Higher Level Stewardship
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
JCS	Joint Core Strategy
kV	Kilovolts
LPA	Local Planning Authority
m	Metre
MAFF	Ministry of Agriculture, Fisheries and Food
NFU	National Farmers Union
NPPF	National Planning Policy Framework
NPS	National Policy Statements
NSRI	National Soil Resources Institute
NSIP	Nationally Significant Infrastructure Project
OELS	Organic Entry Level Stewardship
OCoCP	Outline Code of Construction Practice
PPD	Preferred Policy Direction
PEIR	Preliminary Environmental Information Report
PDS	Project Design Statement
PRoW	Public Right of Way
SMP	Soil Management Plan

Terminology

Cable Relay Station	Primarily comprised of an outdoor compound containing reactors (also called inductors, or coils) and switchgear to increase the power transfer capability of the cables under the HVAC technology scenario as considered in the PEIR. This is no longer required for the project as the HVDC technology has been selected.
Jointing pit	Underground structures constructed at regular intervals along the cable route to join sections of cable and facilitate installation of the cables into the buried

	ducts
Landfall	Where the offshore cables come ashore at Happisburgh South
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing low voltage electrical earthing links.
Mobilisation area	Areas approx. 100 x 100m used as access points to the running track for duct installation. Required to store equipment and provide welfare facilities. Located adjacent to the onshore cable route, accessible from local highways network suitable for the delivery of heavy and oversized materials and equipment.
National Grid overhead line modifications	The works to be undertaken to complete the necessary modification to the existing 400kV overhead lines
National Grid substation extension	The permanent footprint of the National Grid substation extension
Necton National Grid substation	The existing 400kV substation at Necton, which will be the grid connection location for Norfolk Vanguard
Onshore 400kV cable route	Buried high-voltage cables linking the onshore project substation to the Necton National Grid substation
Onshore cables	The cables which take the electricity from landfall to the onshore project substation
Onshore cable corridor	200m wide onshore corridor within which the onshore cable route would be located as submitted for PEIR.
Onshore cable route	The 45m easement which will contain the buried export cables as well as the temporary running track, topsoil storage and excavated material during construction.
Onshore project substation	A compound containing electrical equipment to enable connection to the National Grid. The substation will convert the exported power from HVDC to HVAC, to 400kV (grid voltage). This also contains equipment to help maintain stable grid voltage.
Running track	The track within the onshore cable route which the construction traffic would use to access workfronts
The Applicant	Norfolk Vanguard Limited
The project	Norfolk Vanguard Offshore Wind Farm, including the onshore and offshore infrastructure
Transition pit	Underground structures that house the joints between the offshore export cables and the onshore cables within the landfall zone
Trenchless crossing zone (e.g. HDD)	Temporary areas required for trenchless crossing works.

21 LAND USE & AGRICULTURE

21.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the potential impacts of the proposed Norfolk Vanguard Offshore Wind Farm (hereafter 'the project') on land use and agriculture. The chapter provides an overview of the existing land use where the onshore project area is proposed, followed by an assessment of the potential impacts and associated mitigation for the construction, operation and decommissioning of the project.

2. The focus of this chapter is on land use and agriculture (potential impacts on human beings including landowners, occupiers, local communities and other land users as well as bio-physical elements of soils, the surrounding environment and the productivity of the land). Potential impacts on geology, ground conditions and contamination are considered in Chapter 19 Ground Conditions and Contamination.

3. The assessment also considers cumulative impacts of other proposed projects. The proposed methodology adhered to for the Environmental Impact Assessment (EIA) and Cumulative Impact Assessment (CIA) is discussed in section 21.4.

4. Figures which accompany the text in this chapter are provided in Volume 2 Figures.

5. Because of the close association between land use, agriculture, ground conditions, groundwater, surface water and ecology topics, this chapter should also be read in conjunction with the other related ES chapters (and their appendices and supporting documents). The relevant chapters are:

   - Chapter 19 Ground Conditions and Contamination;
   - Chapter 20 Water Resources and Flood Risk;
   - Chapter 22 Onshore Ecology;
   - Chapter 24 Traffic and Transport;
   - Chapter 28 Onshore Archaeology and Cultural Heritage;
   - Chapter 29 Landscape and Visual Impact Assessment; and
   - Chapter 31 Socio-economics.

21.2 Legislation, Guidance and Policy

6. There are a number of pieces of legislation, policy and guidance applicable to land use and agriculture. The following sections provide detail on key pieces of international and UK legislation, policy and guidance which are relevant to this chapter.

21.2.1 Legislation and Policy

7. The following UK legislation is considered the most relevant to land use and agriculture considered in this chapter.

- Marine and Coastal Access Act 2009;
- The Commons Act 2006;
- The Environmental Stewardship (England) Regulations 2005 (as amended);
- Countryside and Rights of Way Act (CRoW) 2000;
- National Planning Policy Framework (NPPF) 2012; and
- Natural Environment White Paper 2011.

8. Further detail on legislation and policy in relation to the wider project is provided in Chapter 3 Policy and Legislative Context.

9. The assessment of potential impacts upon land use and agriculture has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to the project are:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC) 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC 2011c).

10. The specific requirements of the NPS in relation to land use and agriculture are summarised in Table 21.1, and includes where in the ES they are addressed.

Table 21.1 NPS assessment requirements relevant to land use and agriculture

NPS Requirement	NPS reference	ES reference
EN-1 Overarching NPS for Energy		
The ES [Environmental Statement] should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan.	Section 5.10.5	Details on existing or proposed land uses can be found in section 21.6 and new developments or proposed projects are assessed for potential cumulative impacts in section 21.8.
During any pre-application discussions with the applicant the LPA [Local Planning Authority] should identify any concerns it has about the impacts of the application on land use, having regard to the development plan and relevant applications and including, where relevant, whether it agrees with any independent assessment that the land is surplus to requirements.	Section 5.10.7	Local authorities have identified their concerns as per Table 21.3, section 21.3.

NPS Requirement	NPS reference	ES reference
Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.	Section 5.10.8	See sections 21.6.3, 21.7.1, 21.7.5.2, 21.7.6.2.
The general policies controlling development in the countryside apply with equal force in Green Belts but there is, in addition, a general presumption against inappropriate development within them. Such development should not be approved except in very special circumstances. Applicants should therefore determine whether their proposal, or any part of it, is within an established Green Belt and if it is, whether their proposal may be inappropriate development within the meaning of Green Belt policy (see paragraph 5.10.17 below).	Section 5.10.10	Due to the design principles applied at the site selection stage, the onshore project area has avoided areas of Green Belt.
An applicant may be able to demonstrate that a particular type of energy infrastructure, such as an underground pipeline, which, in Green Belt policy terms, may be considered as an "engineering operation" rather than a building, is not in the circumstances of the application inappropriate development. It may also be possible for an applicant to show that the physical characteristics of a proposed overhead line development or wind farm are such that it has no adverse effects which conflict with the fundamental purposes of Green Belt designation.	Section 5.10.12	Due to the design principles applied at the site selection stage, the onshore project area has avoided areas of Green Belt.
Ensure that applicants do not site their scheme on the best and most versatile agricultural land without justification. It should give little weight to the loss of poorer quality agricultural land (in grades 3b, 4 and 5).	Section 5.10.15	See sections 21.6.3, 21.7.1, 21.7.5.2, 21.7.6.2

21.2.2 Local Planning Policy

11. EN-1 states that the Planning Inspectorate will also consider Development Plan Documents or other documents in the Local Development Framework to be relevant to its decision making.

12. The onshore project area falls under the jurisdiction of Norfolk County Council and the following local planning authorities:

- Broadland District Council;
- North Norfolk District Council; and
- Breckland Council.

13. Within Broadland District there is a Local Plan, which includes the Joint Core Strategy (a partnership between Broadland, Norwich and South Norfolk Councils), the Development Management Development Plan Document (Broadland District Council, 2015) and the Site Allocations (to identify areas for housing, employment, retail, recreation etc.).

14. North Norfolk District Council currently has an Emerging Local Plan 2016-2036, providing the context for development across North Norfolk. Within the Local Plan sit the Core Strategy and Site Allocation Plans setting out more detailed, site specific policies (North Norfolk District Council, 2008, updated 2012).

15. Breckland Council (2011) have an emerging Local Plan 2011-2036. This plan sets out strategic planning policies within Breckland (which replaces the Core Strategy and suite of documents that make up the adopted Local Plan). An updated Emerging Single Local Plan was consulted on in September 2016, with draft documents available online (Breckland Council, 2017).

16. Table 21.2 provides details of the local planning policy documents and the policies contained within these relevant to land use and agriculture.

Table 21.2 Relevant local planning policies

Document	Policy/guidance	Policy/guidance purpose
Norfolk County Council		
Norfolk County Council (2011) Core Strategy and Minerals and Waste Development Management Policies Development Plan Document 2010-2026.	DM16 – Soils.	Development proposals affecting Grade 1 agricultural land will only be permitted in exceptional circumstances, where it is demonstrated that there are no alternative locations for the development.
North Norfolk District Council		
Joint Core Strategy (Broadland, Norwich and South Norfolk) adopted January 2014.	Objective 9	To protect, manage and enhance the natural, built and historic environment, including key landscapes, natural resources and areas of natural habitat or nature conservation value. It is a priority to maintain and improve these special qualities so that everyone can enjoy them. The use of previously developed land will be prioritised to minimise the loss of agricultural land and the countryside. The scale of development we have to accommodate will require the development of some significant greenfield areas, which will affect the existing landscape. Where this is necessary, development must provide environmental gains through green infrastructure, including allotments and community gardens. Biodiversity, geodiversity and locally distinctive landscapes will be protected and enhanced.

Document	Policy/guidance	Policy/guidance purpose
		Linkages between habitats will be promoted, helping to enable adaptation to climate change. Sustainable access to the countryside will be promoted. Efficient use will be made of minerals, energy and water resources, and the production of waste will be minimised.
	Policy 5	The rural economy and diversification will also be supported by: Promotion of farmers markets, farm shops and cottage industry, including the development of a flagship food and farming hub serving the needs of Norfolk and supporting the agri-food sector in and around greater Norwich.
	Policy 7	Healthier lifestyles will be promoted by maximising access by walking and cycling and providing opportunities for social interaction and greater access to green space and the countryside.
	Policy 8	Development will be expected to provide for local cultural and leisure activities, including new or improved built facilities, provide for a range of activities including performance space, and/or access to green space, including formal recreation, country parks and the wider countryside.
	Policy 17	Much of the area is agricultural land forming an attractive backdrop to the existing settlements and the Broads. This area contains many attractive built and natural features including areas of notable landscape character, geological and biodiversity interest. These need to be protected and enhanced, while providing for the rural economy and accessibility to services to be maintained and enhanced. The policy sets out the types of uses that may be acceptable in the countryside. In the case of more significant proposals, these will be considered in the light of their contribution to meeting the overall objectives of the JCS [Joint Core Strategy].
Breckland Council		
Breckland Adopted Core Strategy and Development Control Policies Development Plan Document (Breckland Preferred Sites Sustainability Appraisal, Breckland Local Plan Preferred Directions Consultation Document, Preferred	Policy CP8 Natural Resources	All development must be consistent with the principles of the proper management of natural resources. Development will only be supported where it will enhance, or protect against the non-essential loss of the natural resources of the District. Whilst mechanisms are in place to ensure that the development needs of the

Document	Policy/guidance	Policy/guidance purpose
Sites and Settlement Boundaries).		District are met, development should nevertheless avoid the unnecessary loss of high-grade agricultural land which is a finite resource and is important to the rurality of Breckland.
	Proposed Local Plan Policy PD 03	Identifies Attleborough and Thetford as Key Settlements; Dereham, Swaffham and Watton as Market Towns; and 22 other Local Service Centres based on the District's larger villages (Banham, Great Ellingham, Harling, Litcham, Mattishall, Mundford, Narborough, Necton, North Elmham, Old Buckenham, Saham Toney, Shipdham, Swanton Morley, Weeting, Bawdeswell, Beetley, Garboldisham, Hockering, Hockham, Kenninghall, Sporle and Yaxham).
	Preferred Policy Direction (PPD) PD01	The Local Plan will seek and enable development that improves the economic, social and environmental objectives of Breckland through the application of the following national and locally distinctive sustainable development principles: • Mitigate and adapt to climate change; • Protect and enhance the natural, built and historic environment; • Allocate and facilitate developable land that seeks to provide access to homes, employment, retail, leisure and other facilities; • Assist in the creation and maintenance of inclusive, environmentally sustainable communities making the best and most efficient use of previously developed land, buildings and natural resources; Supports Breckland's wider rural economy helping to sustain local services and assist in helping rural communities adapt and grow proportionately to enhance their social and economic sustainability; Directing jobs and growth towards the most sustainable locations contributing towards the economy and jobs in rural areas, helping to find the right balance throughout the District.

Document	Policy/guidance	Policy/guidance purpose
	PPD ENV 05	Protection and enhancement of the landscape: The landscape of the District will be protected for the sake of its own intrinsic beauty and its benefit to the rural character and in the interests of biodiversity, geodiversity and historic conservation. Development should have particular regard to maintaining the aesthetic and biodiversity qualities of natural and man-made features within the landscape, including a consideration of individual or groups of natural features such as trees, hedges and woodland or rivers, streams or other topographical features.
	PPD TR01	Sustainable transport network will be achieved through … Encouraging walking and cycling, through links to existing routes, and the provision of facilities such as secure, accessible and bicycle parking with changing facilities on site.
	Policy SW1	Land to the east of Brandon Road and north of the Former Redland Tiles Site Land amounting to approximately 10 hectares (ha) is allocated for a residential development of 250 dwellings. A minimum of 0.96ha of outdoor sport provision and 0.48ha of children's play space will be provided on site along with related landscaping and facilities. Development will be subject to compliance with adopted Core Strategy policies.
Broadland District Council		
Development Management Development Plan Document.	DPD EN1 – Biodiversity and Habitats	Development proposals will be expected to protect and enhance the biodiversity of the district, avoid fragmentation of habitats, and support the delivery of a co-ordinated green infrastructure network throughout the district.

17. As part of the Norfolk Minerals and Waste Development Framework (Norfolk County Council, 2013), The Core Strategy and Minerals and Waste Development Management Policies Development Plan Document sets out a spatial vision for the provision of mineral extraction and waste management facilities in Norfolk.

18. Mineral safeguard zones are discussed in Chapter 19 Ground Conditions and Contamination.

21.2.3 Guidance

19. There is no specific industry guidance on assessing the impacts of projects on land use and agriculture, therefore a methodology has been developed and consulted on as part of the ES, for this assessment based on the following sources:

- Highways Agency (2001) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 6 (Land Use) and Part 11 (Geology & Soils); and
- Ministry of Agriculture, Fisheries and Food (MAFF) (1988) Agricultural Land Classification of England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land (Revised Guidelines).

20. In addition to the sources of guidance outlined above there are a number of documents that provide best practice guidance on soil handling and construction management. These offer guidance on methods to reduce the impact on soils and land use, particularly during construction. They are:

- Department for Environment, Food and Rural Affairs (Defra) (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites;
- Defra (1996) Waste Management Duty of Care – A Code of Practice;
- MAFF (2000) Good Practice Guide for Handling Soils;
- MAFF (1991) Practical Guide to Preventing the Spread of Plant and Animal Diseases;
- Environment Agency (2010) Managing Invasive Non-native Plants; and
- Natural England (2012) Agricultural Land Classification: Protecting the Best and Most Versatile Agricultural land.

21.3 Consultation

21. Consultation is a key driver of the EIA and ES, and is an ongoing process throughout the lifecycle of the project, from the initial stages through to consent and post-consent. To date, consultation regarding land use and agriculture has been conducted through Expert Topic Group (ETG) meetings, the Scoping Report (Royal HaskoningDHV, 2016) and the Preliminary Environmental Information Report (PEIR) (Norfolk Vanguard Limited, 2017). Full details of the project consultation process are presented within Chapter 7 Technical Consultation. Ongoing landowner discussions are also being undertaken to help inform the project, and have fed into key project design decisions such as the cable route alignment. Whilst individual responses are not captured here, these are collated in the Consultation Report (document reference 5.1), which has been submitted with the DCO application.

22. A summary of the consultation that has been undertaken to date and has driven forward the development of this land use and agriculture assessment is provided in Table 21.3. Further consultation responses are provided in Appendix 21.1.

Table 21.3 Consultation responses

Consultee	Document / date received	Comment	Response / where addressed in the ES
Secretary of State	Scoping Opinion November 2016	In addition to detailed baseline information to be provided within topic specific chapters of the ES, the Secretary of State would expect the ES to include a section that summarises the site and surroundings. This would identify the context of the proposed development, any relevant designations and sensitive receptors. This section should identify land that could be directly or indirectly affected by the proposed development and any associated auxiliary facilities, landscaping areas and potential off site mitigation or compensation schemes that are to be included as part of the proposed development.	Baseline information is provided in section 21.6. Chapter 22 Onshore Ecology, Chapter 28 Onshore Archaeology and Cultural Heritage and Chapter 29 Landscape and Visual Impact Assessment provide further detailed information on site, surroundings, designations and sensitive receptors.
Secretary of State	Scoping Opinion November 2016	With regards to Table 3.24, the Secretary of State considers that Water Resources and Flood Risk also have the potential to have effects on Land Use.	This is addressed in section 21.9 where inter-relationships between land use and other topics are identified and considered. Chapter 20 Water Resources and Flood Risk also considers these inter-relationships.
Secretary of State	Scoping Opinion November 2016	Careful consideration should be given to the siting of the onshore infrastructure in relation to agricultural land; the potential temporary and permanent loss of Agricultural Land Classification (ALC) land should be assessed within the ES. The potential effects on soil quality should be considered and relevant mitigation measures proposed.	Impacts on agricultural activities in relation to ALC-graded land are discussed in section 21.7.5.2. Chapter 4 Site Selection and Assessment of Alternatives provides further information on the considerate siting of project infrastructure.
Secretary of State	Scoping Opinion November 2016	The potential for sterilisation of land along the cable route should be assessed within the ES, including	The potential impacts of land sterilisation are discussed in section

Consultee	Document / date received	Comment	Response / where addressed in the ES
		interrelated socioeconomic effects.	21.7.5.2.
Secretary of State	Scoping Opinion November 2016	The Scoping Report identifies the Norfolk Coast Path, Public Rights of Way and Cycle Trails. Norfolk County Council's response (see Appendix 3 of this Opinion) identifies a number of long distance trails which should be acknowledged e.g. Paston Way and the Weavers Way. Appropriate cross reference should be made to the tourism and recreation chapter of the ES.	The potential impacts on Public Rights of Way (PRoW) are discussed in section 21.7 and Chapter 30 Tourism and Recreation.
Secretary of State	Scoping Opinion November 2016	The Secretary of State welcomes the proposal for a Soils Management Plan and recommends a draft is provided with the DCO application. The relationship of this plan to other relevant plans should also be specified (e.g. if it is to be appended to any CoCP, CEMP [Construction Environment Management Plan] or similar).	The principles upon which the final Soils Management Plan (SMP) will be based prior to construction are included in the Outline Code of Construction Practice (OCoCP) (document reference 8.1) submitted as part of the DCO application. Mitigation measures in relation to soils and drainage are considered in section 21.7.5.1.
Natural England	Scoping Opinion November 2016	Soil and Agricultural Land Quality Impacts from the development should be considered in light of the Government's policy for the protection of the best and most versatile (BMV) agricultural land as set out in paragraph 112 of the National Policy Planning Framework (NPPF). We also recommend that soils should be considered under a more general heading of sustainable use of land and the ecosystem services they provide as a natural resource in line with paragraph 109 of the NPPF.	Included in section 21.6.4.1 and referred to in Table 21.1. Mitigation measures in relation to soils and drainage are considered in section 21.7.5.1.
Campaign to Protect Rural England (CPRE)	PEIR December 2017	The potential temporary and permanent loss of Agricultural Land Classification land should be assessed within the ES. At this PEIR	Impacts on agricultural activities in relation to ALC-graded land are discussed in section

Consultee	Document / date received	Comment	Response / where addressed in the ES
		stage it is estimated to be 21% of the temporary strip along a 60km route.	21.7.5.2.
CPRE	PEIR December 2017	The NSIP process, and the misuse of the Rochdale Envelope, are particularly weak in recognising the wider benefits of ecosystem services; and minimising impacts on biodiversity and providing net gains in biodiversity, where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures.	Soil resources in the context of ecosystem services and natural capital are discussed in section 21.6.4.1. Impacts related to biodiversity and ecological networks are discussed in Chapter 22 Onshore Ecology section 22.6.4.
Norfolk County Council	PEIR November 2017	The report indicates that the onshore project area will largely be located on rural, agricultural land. Therefore, the majority of the project shall be located within areas where there are no existing formal surface water drainage systems, other than agricultural land drains and ordinary watercourses. Risk to any nearby properties should also be considered.	Potential impacts to drainage are discussed in section 21.7.5.1. A Flood Risk Assessment has also been carried out and can be found in Appendix 20.1 Flood Risk Assessment of Chapter 20 Water Resources and Flood Risk.
Norfolk County Council	PEIR November 2017	The County Council would wish to see that any drainage strategies contain maintenance and management plans detailing the activities required and who will adopt and maintain the surface water drainage features for the lifetime of the development.	Drainage mitigation measures are discussed in section 21.7.5.1.
North Norfolk District Council	PEIR December 2017	The District Council is aware, through the delivery of earlier offshore wind cable routes across North Norfolk, that there might be different impacts on farm businesses of compensation payments made to tenant farmers, relative to principal landowners, and would ask Vattenfall to carefully consider the interests of such farmers so that their businesses aren't disadvantaged through payments made to landowners without	Potential impacts on agricultural activities and proposed mitigation measures including private agreements between Norfolk Vanguard Limited and relevant landowners/occupiers including tenants and contracting parties are discussed in section 21.7.5.2.4, 21.7.5.1

Consultee	Document / date received	Comment	Response / where addressed in the ES
		reference to the tenant farming enterprise. However, the District Council would also expect Vattenfall to liaise with farmers, landowners and their contracting partners in order to minimise the wider impact of the construction works programme on planting, harvesting operations etc in terms of vehicular access along very narrow roads, so that time critical operations such as harvesting around weather windows are not compromised.	and 21.7.6.2.4. Compensation will be payable to landowners through the private agreements subject to the landowner mitigating their losses (in line with the compulsory purchase compensation code) where possible.
National Farmers Union (NFU)	PEIR December 2017	Detailed Design It is thought important that there is enough detail regarding the design so that landowners and occupiers can understand how the construction of the project will affect their agricultural businesses on a temporary basis during construction and on a permanent basis once construction is complete.	Details of the project during construction and operation are found in Chapter 5 Project Description.
NFU	PEIR December 2017	Phasing of the Project The NFU would like to understand the construction timings in more detail if the project is carried in two or three phases. The greater the time to construct the project the greater the impact will be on agricultural businesses. It is understood that the longest time construction period may be for 6 years if the project is carried out through a three phase scenario. Some farm businesses will not be able to lose a strip of land from the business with all the associated problems of access to their remaining land for 6 years. A construction timetable needs to be clarified so that all landowners and occupiers can understand the impact the project is likely to have on their farming business.	Details of the project during construction and operation, including programme and phasing scenarios, are found in Chapter 5 Project Description.
NFU	PEIR December 2017	It is really important that this	Trenches would be

Consultee	Document / date received	Comment	Response / where addressed in the ES
		minimum [trench] depth can be achieved so that normal every day agricultural operations will not be affected like ploughing and sub soiling. A further discussion on duct depth is requested so that the interrelation to field drainage can be understood. We see that it has been stated that it is thought that the ducts at the 1.05m will be below field drainage.	approximately 1m in width and the ducts would be buried to a minimum depth of 1.05m (from top of duct to surface). The cable circuits would be installed in a flat formation (each cable core installed alongside another). This minimum depth is equivalent to the electricity distribution provider in Norfolk's standard depth. Further details regarding construction can be found in Chapter 5 Project Description.
NFU	PEIR December 2017	Link boxes Clarification is needed on how many link boxes will be needed at the end of every run? It is requested that link boxes where possible are located in field boundaries or field corners to reduce the interference on farming operations. It is extremely important to have further design information on link boxes and the siting of them. This includes any link boxes that may be located in a cluster and how will they be marked/identified/fenced.	Link boxes will be sited alongside field boundaries where possible, to minimise the sterilisation of land parcels. Information on the number and details of identification of link boxes can be found in chapter 5 Project Description.
NFU	PEIR December 2017	Land (Field) Drainage and Soils The NFU would like to agree standard terms of how field drainage will be treated in principle on every farm and for this wording to be taken forward and included in the Soil Management Plan and for this document to be certified as part of the Development Consent Order. The wording normally covers before, during and after construction. It will be important in places for field	Potential impacts on drainage and associated mitigation measures are discussed in section 21.7.5.1. This includes the provision of a specialist drainage contractor to provide mapping and figures where appropriate prior to and post construction,

Consultee	Document / date received	Comment	Response / where addressed in the ES
		drainage to take place outside of the order limits and this will need to be agreed along with a local drainage consultant being taken on by Vattenfall at the pre –construction stage. Vattenfall must be prepared on behalf of all landowners and occupiers affected by the scheme to reinstate drainage systems to landowners' reasonable satisfaction and to ensure that the drainage system is put back in a condition that is as least as effective as the previous condition.	to identify field drains and ensure their protection during construction. Handling and protection of soils and drainage systems will be managed through the Soil Management Plan, which has been produced and submitted alongside the DCO application.
NFU	PEIR December 2017	Soils Details of how soils will be treated and where stored during construction must be provided. Along with how sub and top soils will be kept separate and kept clean during the construction period. During very wet conditions and if soils are waterlogged construction should be stopped. Further it is important for Vattenfall to set out how after soil has been reinstated what measures will be put in place to bring the soil back to its condition and quality before the works took place. An after care plan should be included in a Code of Construction. To enable the aftercare plan to be put in place Vattenfall must make sure that a record of condition is taken pre –construction including soil samples to determine the soil structure and the nutrients. This can then be used to set a soil target specification for each field on a holding. The soil target must also include yield records which can be provided by the landowner/occupier. The NFU would like to see draft documents [Code of Construction Practice and Soil Management Plan] as soon as further details are available and before the submission of the DCO.	Potential impacts on soils are discussed in section 21.6.4 and 21.7.5.3. Handling and protection of soils, including measures such as the separate storage of topsoil and subsoil, and ceasing work during wet weather, will be managed through the Soil Management Plan, which has been produced and submitted alongside the DCO application. The Code of Construction Practice (CoCP) will also include best practice measures for soil handling.

Consultee	Document / date received	Comment	Response / where addressed in the ES
Costessy Town Council	PEIR December 2017	Council has concerns that the proposed line will cross that of another recently proposed offshore wind farm: Hornsea Three, and is worried that there will be adverse effects from the crossing of two major lines which would not have occurred from a single line installation.	Potential cumulative impacts on soils and agriculture are considered in the Cumulative Impact Assessment (section 21.8).

21.4 Assessment Methodology

21.4.1 Impact Assessment Methodology

23. Chapter 6 EIA Methodology details the general impact assessment method, and the following sections describe more specifically the methodology used to assess the potential impacts of the project on onshore land use and agriculture, as consulted on and agreed via a method statement, Expert Topic Group (ETG) meetings since 2017, the Scoping Report (Royal HaskoningDHV, 2016) and the Preliminary Environmental Information Report (PEIR) (Norfolk Vanguard Limited, 2017).

24. Two key groups of impacts have been identified for the purpose of defining receptor sensitivity and impact magnitude in this assessment:

- Land use and tenure: these are the potential impacts on human beings, including landowners, occupiers, local communities and other land users. Potential impacts on land users in relation to tourism and recreational activities such as cycle routes, PRoW and national trails are considered in Chapter 30 Tourism and Recreation; and
- Agriculture: these are potential impacts on the bio-physical elements of soils, the surrounding environment and the productivity of the land. The focus of the assessment in this chapter is on agricultural productivity and soil resource. Geology, ground conditions and contamination are considered in Chapter 19 Soils, Geology and Ground Conditions.

25. Whilst there are clear links between the two impact groups, the assessment of receptor sensitivity and magnitude of effect will differ.

26. The scope of the assessment for land use and agricultural environment identifies the existing environment, as characterised by the following:

- Land use policies and designations;
- Agricultural activities;

- ALC system;
- Soil type;
- Environmental Stewardship Schemes (ESS);
- Injurious weeds and invasive plant species;
- Utilities; and
- Open access and common land.

27. Impacts on PROW and cycle routes, including bridleways, national trails and long distance trails are assessed in Chapter 29 Landscape and Visual Impact Assessment and Chapter 30 Tourism and Recreation, and are not considered further in this chapter.

28. ALC grades and descriptions are shown in Table 21.4.

Table 21.4 ALC grades[1] and descriptions

Grade	Description
Grade 1 – Excellent Quality Agricultural Land	Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.
Grade 2 – Very Good Quality Agricultural Land	Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.
Grade 3 – Good to Moderate Quality Agricultural Land	Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.
Subgrade 3a – Good Quality Agricultural Land	Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.
Subgrade 3b– Moderate Quality Agricultural Land	Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.
Grade 4 – Poor Quality Agricultural Land	Land with severe limitations, which significantly restrict the range of crops and / or level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.
Grade 5 – Very Poor Quality Agricultural Land	Land with very severe limitations, which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

[1] Source: Agricultural Land Classification of England and Wales, Ministry of Agriculture, Fisheries and Food, 1988 [online]. Available at: http://webarchive.nationalarchives.gov.uk/20130402200910/http://archive.defra.gov.uk/foodfarm/landmanage/land-use/documents/alc-guidelines-1988.pdf [Accessed 17/04/2017].

Grade	Description
Urban	Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, and cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants.

21.4.1.1 Sensitivity

29. The sensitivity of receptors is assessed according to the criteria set out in Table 21.5 and is based on the capacity of receptors to tolerate change and whether or not increased risks would be acceptable within the scope of the prevailing legislation and guidelines. The degree of change that is considered to be acceptable is dependent on the susceptibility of the receptor to the change that the project would have on the land use.

Table 21.5 Definitions of sensitivity levels for land use receptors

Sensitivity	Land use and tenure	Agriculture and soils
High	Receptor has no or very limited capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• Higher level ESSs; • Future planning applications for large scale planning uses; • Internationally and nationally designated planning policy areas; or • Land uses that are not possible elsewhere or regionally scarce and cannot be adapted or replaced e.g. the ecosystem service functions of soils.	• ALC Grade 1 or 2 land; • Farming practices with specific requirements; • Land with Notifiable Weeds (risk of spread) • Land with notifiable Scheduled diseases (risk of spread); or • Soil vulnerable to structural damage and erosion or unrecoverable or not adaptable to changes.
Medium	Receptor has limited capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• Entry level or Entry Level with Higher ESS; or • Local designated planning policy areas.	• ALC Grade 3; or • Seasonally susceptible to structural damage or erosion.
Low	Receptor has moderate capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• No designated planning policy areas; • No ESS's but under other environmental management; • Land used for ordinary agriculture or horticulture; or • Large agricultural holdings.	• ALC Grade 4 land; • Arable or pasture grassland; or • Medium to course material, some resistance to structural damage the majority of the year.
Negligible	Receptor generally tolerant of changes to the land use such as loss of land areas, soil degradation etc.	
	• No designated planning policy areas; or • No ESS.	• ALC Grade 5 land; • Non-agricultural and urban, non-arable or pasture grassland; or

Sensitivity	Land use and tenure	Agriculture and soils
		• Greater resistance to soil structural damage.

21.4.1.2 Magnitude

30. Potential impacts may be adverse, beneficial or neutral. Impact magnitude on a receptor has been defined with consideration of the spatial extent, duration, frequency and severity of the effect. Impact magnitude is assessed qualitatively according to the criteria defined in Table 21.6.

31. The following definitions apply to the time periods used in the magnitude assessment:

- Long term: Greater than 5 years;
- Medium term: 2 to 5 years; and
- Short term: Less than 2 years.

32. Based on the above definitions, construction-related impacts are considered a short term impact magnitude within the assessment and relate to impacts that do not extend past the construction period.

Table 21.6 Definitions of magnitude levels for land use receptors

Magnitude	Land use and tenure	Agriculture and soils
High	• Permanent (>10 years) / irreversible changes, over the whole receptor, affecting usability, risk, value over a wide area, or certain to affect regulatory compliance.	• Permanent loss of over 20ha of the BMV agricultural land (grades 1, 2 and 3a) or more than 60% total regional resource (Natural England, 2012a); • Full recovery of land would take more than 10 years; or • Existing land use would not be able to continue on more than 5ha of land or the entire landowner/occupiers available land (where smaller) where the land would be rendered unviable for agricultural purposes OR permanent changes to land management would be required.
Medium	• Moderate permanent or long-term (5-10 years) reversible changes, over the majority of the receptor, affecting usability, risk, value over the local area, possibly affecting regulatory compliance; • Existing land use would not be able to continue on less than 5ha of land or • Noticeable changes to the existing land use although it may continue.	• Medium to long term loss of more than 20ha of the BMV agricultural land or more than 60% of the regional resource; • Permanent loss of more than 10ha of ALC (grade 3b) agricultural land; • Full recovery of land is expected within 5 to 10 years; • More than 20ha of soil is temporarily unsuitable for agriculture or • Small areas (<10ha) of any agricultural land permanently lost from agriculture
Low	• Temporary change affecting usability, risk or value over the short-term (<5 years); or • Temporary change affecting usability within the site boundary;	• Short term loss of more than 20ha, or permanent loss of more than 10ha of ALC Grade 4 land or more than 10% of regional resource; • Full recovery of land is expected within 5 years; or • Less than 20ha of soil is temporarily unsuitable for

Magnitude	Land use and tenure	Agriculture and soils
	measurable permanent change with minimal effect usability, risk or value; no effect on regulatory compliance.	agriculture or less than 1ha is permanently lost from agriculture.
Negligible	• Minor permanent or temporary change, undiscernible over the medium- to long-term short-term, with no effect on usability, risk or value.	• No material change to the soil resource has been identified or • Small areas <1,000m^2 is permanently lost from agriculture

21.4.1.3 Impact significance

33. Following the identification of receptor sensitivity and magnitude of the effect, it is possible to determine the significance of the impact. A matrix is presented in Table 21.7 and will be used wherever relevant. Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive tool.

Table 21.7 Impact significance matrix

		Negative magnitude				Beneficial magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	*Major*	*Major*	*Moderate*	*Minor*	*Minor*	*Moderate*	*Major*	*Major*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Minor*	*Minor*	*Moderate*	*Major*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

34. As with the definitions of magnitude and sensitivity, the matrix used for land use and agriculture is defined and the impact significance categories are divided as shown in Table 21.8.

Table 21.8 Impact significance definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely

Impact Significance	Definition
	to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore no change in receptor condition.

35. Note that for the purposes of this ES, major and moderate impacts are deemed to be 'significant'. In addition, whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

36. Embedded mitigation is included in the initial assessment of impact. If the impact does not require mitigation (or none is possible) the residual impact will remain the same. If additional mitigation is required there will also be an assessment of the post-mitigation residual impact.

21.4.2 Cumulative Impact Assessment

37. Chapter 6 EIA Methodology provides a general methodology with regards to the CIA.

38. The potential for cumulative effects has been considered for the construction, operation and decommissioning of the onshore project area cumulatively with the offshore project area as well as with other onshore projects.

39. Cumulative impacts are discussed where the onshore project area has the potential to overlap with similar impacts arising from:

- Recent development, either built or under construction (which is not considered as part of the baseline);
- Approved development, awaiting implementation; and
- Proposals awaiting determination within the planning process with design information in the public domain.

40. The CIA involves consideration of whether impacts on a receptor can occur on a cumulative basis between the project and other activities, projects and plans for which sufficient information regarding location and scale exist.

41. For further details of the methods used for the CIA for land use, see section 21.8.

21.4.3 Transboundary Impact Assessment

42. There are no transboundary impacts with regards to land use and agriculture as the onshore project area is entirely within the UK and would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and will not be considered further.

21.5 Scope

21.5.1 Study Area

43. The onshore project area includes the following elements:

- Landfall;
- Onshore cable route, accesses, trenchless crossing techniques (e.g. Horizontal Directional Drilling (HDD)) and mobilisation areas;
- Onshore project substation; and
- Extension to the Necton National Grid substation and overhead line modification.

44. A full description of the above onshore infrastructure is provided in Chapter 5 Project Description.

45. For the purpose of this assessment, and to aid the baseline descriptions, study areas have been determined by a number of factors such as the distribution of receptors, footprint of potential impact, political/management boundaries, and were consulted on during the PEIR consultation (December 2017).

46. The following study areas have been defined to assess the direct and indirect impacts associated with the project:

- Onshore project area: as outlined in Chapter 5 Project Description. This is considered to be the largest area over which direct impacts (e.g. loss of land, soil degradation) would be experienced.
- Local or parish boundary: this study area is used to assess direct and indirect impacts and provides the first point on the scale to assess impacts at a local level. For example, the onshore project substation will be located in the Necton parish.
- Local planning authority boundary: this is the study area for direct and indirect impacts and provides the second point on the scale to assess impacts at a district context. This incorporates the entire boroughs of Breckland, Broadland and North Norfolk. This has been selected as this is the spatial level at which local plan policy is made and development objectives are applicable as the local planning authorities.
- County boundary is used to assess indirect impacts and provides the third point on the scale to assess impacts at a county level of Norfolk, for example to identify impacts on the agricultural industry (e.g. agricultural productivity). The onshore project area is wholly within the county of Norfolk.

47. The development footprint and local parish and local authority boundaries are shown on Figure 21.1.

21.5.2 Data Sources

48. The data sources used to inform the land use and agricultural baseline, and the confidence levels associated with each data source, are listed in Table 21.9.

Table 21.9 Data sources

Data	Source	Year	Coverage	Confidence	Notes
'A' Roads, Railway Lines and Urban Area	Ordnance Survey	2016	Landfall, onshore cable route, onshore project substation	High	N/A
Datasets on the structure of the agricultural industry	Defra	2013-2015	Norfolk	High	N/A
Soil types	Cranfield University	2017	Landfall, onshore cable route, onshore project substation	High	N/A
Invasive species	Biological records and Phase 1 surveys	2017	Landfall, onshore cable route, onshore project substation	High	N/A
The June Survey of Agricultural and Horticultural Activity.	Defra	2013	Norfolk	High	2016 survey was not broken down into regions, therefore 2013 last detailed information currently available
ALC and agri-environment schemes	Natural England	2015, 2017	England and Wales	High	Locations and details
Agricultural activities	Land agents	2017	Norfolk	Medium	High level qualitative data on agricultural activities in Norfolk and specific to the study area
Utilities search e.g. high pressure gas pipelines	EMAP, GHD	2014, 2017 and 2018	Landfall and onshore cable route	High	Locations and details
Breckland Adopted Core	Breckland Council	2011 and	Onshore cable route, onshore	High	N/A

Data	Source	Year	Coverage	Confidence	Notes
Strategy and Development Control Policies Development Plan Document		2016	project substation		
Broadland District Development Management Development Plan	Broadland District Council	2015	Onshore cable route	High	N/A
North Norfolk Core Strategy (2008) to 2021	North Norfolk District Council	2008 (updated 2012)	Onshore cable route	High	N/A
Joint Core Strategy (Broadland, Norwich and South Norfolk)	Broadland District Council, North Norfolk District Council	2014	Onshore cable route	High	N/A

21.6 Existing Environment

49. This section describes the existing environment in relation to land use and agriculture. It is based on a desk-top study of sources identified in Table 21.9 as a basis for the impact assessment.

50. Norfolk is a rural county with 53% of its population designated as living in rural areas (Norfolk Rural Development Strategy, 2013). The primary land use within the area covered by the onshore project area is agricultural (Figure 21.2). Within the vicinity of the onshore project area there are a number of rural towns and villages. Urban areas including Dereham, Aylsham, Reepham and North Walsham are adjacent to but outside of the onshore project area.

51. The landfall, onshore cable route and onshore project substation (including the National Grid substation extension) are all located within primarily agricultural land, with some areas of improved or semi-improved grassland, mixed deciduous woodland, coniferous plantations, hedgerows and waterbodies. Further information on the habitats and ecology of the onshore project area can be found in Chapter 22 Onshore Ecology.

52. The Dudgeon Offshore Wind Farm onshore substation is immediately adjacent to the Necton National Grid substation extension, and just under 1km from the onshore project substation.

53. The site selection process for the onshore cable route has been developed in adherence with key design principles of routing in order to minimise impacts where possible, including to avoid areas of woodland, urban areas, and sites designated for nature conservation or cultural heritage. For further information please see section 21.7.1 for mitigation that has been embedded into the project design, and Chapter 4 Site Selection and Assessment of Alternatives.

21.6.1 Land Use and Agriculture Policies and Designations

54. A review of Breckland Council, Broadland District Council and North Norfolk District Council local plans was undertaken to identify any parcels of land that are allocated for, or restrict, future development or change of use. This included a review of the proposals map for each of the local authorities.

55. The relevant planning policies in relation to land use and agriculture are outlined in section 21.2.2.

56. The onshore project substation and onshore cable route through Breckland District do not cross any preferred or alternative sites designated for housing (Breckland Council, 2016). Breckland Policy SW1 has been highlighted in Table 21.2 due to the potential for cumulative impacts to occur as a result of the project under Policy SW1. This is assessed in section 21.8.

57. The onshore cable route through Breckland crosses the following County Wildlife Sites; Little Wood north of Dereham, the Wendling Carr west of Dereham and passes next to Necton Wood at Necton.

58. Within Broadland District the onshore cable route passes across an area designated for conservation (under Planning Policy EN2), north of Aylsham to the east of the River Bure (Broadland District Council, 2015), and the Marriott's Way County Wildlife Site west of Reepham (Figure 21.3).

59. North Norfolk District Council identify Happisburgh within their Core Strategy as a Coastal Service Village, ensuring development supports local communities in the face of coastal erosion and flood risk; and North Walsham as a Principal Settlement, along with Cromer, Holt and Fakenham. The majority of commercial and residential development will take place in these Principal Settlement areas (75% of new employment land and 50% of new homes). The landfall is immediately to the south of Happisburgh, and the onshore cable route passes immediately to the north of North Walsham.

60. Policies and designations relevant to land use and agriculture in relation to the onshore project area are shown on Figure 21.3.

21.6.2 Agricultural Activities

61. This section describes the baseline environment in terms of agricultural land cover, including the crops grown and agricultural practices adopted where these are known. It should be noted that this assessment is based on high level datasets which are only accurate at the time of data collection, and therefore should only be considered indicative of the land uses found within the study areas.

62. Agriculture in Norfolk is primarily arable or mixed use. Farm sizes range from less than 5ha to more than 100ha (Defra, 2013). Soil types vary from clays, loam to light sands. Crops grown include cereals and combinable crops (wheat, barley, and oil seed rape) and root crops (sugar beet and potatoes and vegetable crops) (Consents Solutions, 2017). Other agricultural land uses within the study area include rhubarb farming, long term crops such as plantations and poultry, pig and dairy farming.

63. Norfolk contains over 5% of the total of the agricultural sector in England (Norfolk Rural Development Strategy Steering Group, 2013). The rural economy in Norfolk accounts for 44% of jobs in the county, and has the largest agricultural sector of any English county, with a GVA[2] of £50,000 per job, and is therefore an important part of the county's economy (Norfolk Rural Development Strategy, 2013).

64. The total area of farmed land in Norfolk as of 2013[3] is 411,085ha (Defra, 2013). The footprint of agricultural land in the onshore project area constitutes approximately 0.1% of the county resource.

65. Field drainage systems are a vital part of agriculture in Norfolk and made of ceramic, clay or other materials. In some cases these systems are not mapped.

21.6.3 Agricultural Land Classification

66. Agricultural land in England and Wales has been classified according to the quality and versatility of soil in a grading system (the ALC), and is based on factors including climate, nature of the soil and site-based factors (MAFF, 1988). It is a national system in which maps have been produced for the whole of England and Wales. The grading system was defined by the former MAFF (now Defra), and is described in Table 21.4. Land across the onshore project area ranges from ALC grades 1 to 4 (Figure 21.4).

67. The onshore cable route from landfall to the onshore grid connection at the Necton National Grid substation crosses ALC grades 1-4, primarily consisting of ALC Grade 2 and 3. The landfall at Happisburgh South and some of the onshore cable route

[2] Gross value added is the measure of the value of goods and services produced in an area, industry or sector
[3] County level breakdowns are now only available in years that correspond to the EU Farm Structure Survey. The latest available county results are for 2010 and 2013. The next updates will relate to 2016 and then 2020. At the time of writing these were not yet available. For interim years, regional level data is now supplied.

crosses ALC Grade 1. The majority of the onshore cable route and mobilisation zones cross ALC Grades 2 and 3. North east of Dereham, the onshore cable route crosses some ALC Grade 4 land.

68. The existing land at the onshore project substation comprises ALC Grade 3, with the temporary construction area for the National Grid substation extension zone including the overhead line modifications located within Grade 2 and 3 land. The permanent footprint of the National Grid substation extension and overhead line modifications are entirely within ALC Grade 2 land.

69. The percentage of land of different ALC grades within the onshore project area is presented in Table 21.10.

Table 21.10 Percentage of land of different ALC grades within the onshore project area

ALC grade	Hectares	% ALC grade land within onshore project area	ALC grade land within onshore project area as a % of total ALC grade land in Norfolk
1	57.62	10.72	0.01
2	153.29	28.6	0.04
3 (undifferentiated)	276.18	51.5	0.07
4	5.60	1.04	0.001
5	1.58	0.29	<0.001
Non-agricultural/urban[4]	0.05	0.01	<0.001

21.6.4 Soil Type

70. This section provides a description of the soils found within the direct study area in relation to the type, drainage, texture, fertility, moisture and expected land cover. Chapter 20 Water Resources and Flood Risk provides further details on soils in relation to flood risk, water and local drainage.

71. Any impact on the soil resource is not predicted to extend beyond the direct study area, therefore impacts to the wider county level study areas are not discussed. It should be noted that the published soil data provides generic characteristics and are indicative of the soil type present. The precise soil type and characteristics will differ between and within individual fields and these have been verified by the ground investigations survey undertaken in 2017 (see Chapter 19 Ground Conditions and Contamination, Figure 19.2).

[4] This small area is taking account of roads and tracks that intersect the onshore cable route. See Chapter 5 Project Description Table 5.33 for information on crossing techniques.

72. The soils within the direct study area are dominated by acidic, loamy soils around the landfall and in the east of the onshore cable route and acidic, loamy and clayey soils in the west around the onshore project substation. The soils are from low natural fertility (without the addition of fertilisers) in the east to moderate natural fertility to the west and around the onshore project substation.

73. Table 21.11 provides additional detail on the characteristics of the soil types found within the study area (National Soil Resources Institute (NSRI), undated).

Table 21.11 Soil types within the onshore project area

Freely draining slightly acid loamy soils	
Typical Habitats (Semi-natural vegetation).	Neutral and acid pastures and deciduous woodlands; acid communities such as bracken and gorse in the uplands.
Texture.	Loamy.
Drainage type.	Freely draining.
Natural fertility.	Low.
Slowly permeable seasonally wet acid loamy and clayey soils	
Typical Habitats (Semi-natural vegetation).	Seasonally wet pastures and woodlands mainly, but not exclusively, on the upland fringe.
Texture.	Loamy.
Drainage type.	Impeded drainage.
Natural fertility.	Low
Loamy and sandy soils with naturally high groundwater and a peaty surface	
Typical Habitats (Semi-natural vegetation)	Wet meadows and pastures with wet fen communities.
Texture	Peaty
Drainage type	Naturally wet
Natural fertility	Low to high
Slightly acid loamy and clayey soils with impeded drainage	
Typical Habitats (Semi-natural vegetation)	Wide range of pasture and generally broadleaved and mixed woodland types
Texture	Loamy
Drainage type	Slightly impeded drainage
Natural fertility	Moderate to high
Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils	
Typical Habitats (Semi-natural vegetation)	Lowland seasonally wet pastures and woodlands
Texture	Loamy
Drainage type	Impeded drainage
Natural fertility	Moderate

Freely draining slightly acid sandy soils	
Typical Habitats (Semi-natural vegetation)	Freely draining slightly acid sandy soils
Texture	Sandy
Drainage type	Freely draining
Natural fertility	Low

74. The NSRI provides a classification for Expected Crops and Land Use based on land uses and land cover commonly associated with individual soil types. Those relevant to the study area are:

- Suitable for a range of spring and autumn sown crops; under grass the soils have a long grazing season. Free drainage reduces the risk of soil damage from grazing animals or farm machinery. Shortage of soil moisture most likely limiting factor on yields, particularly where stony or shallow;
- Mostly suited to grass production for dairying or beef; some cereal production often for feed. Timeliness of stocking and fieldwork is important, and wet ground conditions should be avoided at the beginning and end of the growing season to prevent damage to soil structure. Land is tile drained and periodic moling or subsoiling will assist drainage;
- Cereals, roots, potatoes and field vegetables provided groundwater is controlled. Ease of working and winter harvesting, which can be damaging to structure, dependent on texture and drainage of subsoil. Irrigation needed on lighter soils;
- Suitable for wide range of spring and autumn sown crops including irrigated roots, potatoes and field vegetables; lime and fertiliser rapidly leached; shortage of soil moisture will limit yield without irrigation;
- Reasonably flexible but more suited to autumn sown crops and grassland; soil conditions may limit safe groundwork and grazing, particularly in spring; and
- Mostly suited to grass production for dairying or beef; some cereal production often for feed. Timeliness of stocking and fieldwork is important, and wet ground conditions should be avoided at the beginning and end of the growing season to avoid damage to soil structure. Land is tile drained and periodic moling or subsoiling will assist drainage.

21.6.4.1 Soil natural capital, ecosystem services and carbon resource

75. The concepts of ‘natural capital’ and ‘ecosystem services’ are used to bring together scientific and economic considerations so that the potential impact of ecosystem modification and the way it may affect society can be assessed more fully. Natural capital in the context of soils can be considered in terms of the mass, energy and entropy (organisation) stored within the soil. Soil ecosystem services refer to the

functions and processes through which soils produce resources used by humans. These are summarised in Table 21.12.

Table 21.12 Soil natural capital and ecosystem services

Mass (constituents of the soil matrix)	Description
Mass (constituents of the soil matrix)	Inorganic content (minerals and nutrients); Organic content (carbon and organisms); Water; and Air.
Energy	Temperature and biomass.
Entropy (organisation)	Soil physical and chemical structure; Organisation of biological populations, food webs and biodiversity; and Spatial and temporal structure.
Soil Ecosystem Services	**Description**
Support functions	Supporting food and fibre production, ecological habitat and diversity through: Physical stability and medium for supporting plants; Supply of plant nutrients; and Role as habitat and gene pool/seed bank.
Regulation functions	Regulation of major elemental cycles – macronutrients (N, P and K) and micronutrients; Regulation and buffering of the hydrological cycle and attenuation of pollutants; and Regulation/cycling of organic matter (waste decomposition and carbon cycle.
Provisioning functions	Use as a raw material for development; and Providing a platform for development.
Cultural functions	Repository for, and protection of, archaeological artefacts and structures of heritage value; and Location of religious/spiritually significant sites/structures (e.g. burial grounds).

76. Soils hold a large reserve of organic carbon, which may be lost as a result of land use change and changes as a result of human activity (including climate change), resulting in the release of greenhouse gases. This may also impact other ecosystem services such as food security, biodiversity and the storage of water. Conversely, agricultural management practices and the use of waste materials may allow more carbon to be stored in soils. It should be noted, however, that currently evidence of a direct linkage between land management activities, changes in soil carbon and greenhouse gas emissions is poor. The highest concentration of carbon storage is in blanket peats. These are not found within the study area.

77. Over 95% of the UK land carbon stock is held within the soil, an estimated 9.8±2.4 billion tonnes, of which 2.8 billion tonnes is held in England and Wales. Whilst bog habitats were found to have by far the greatest average carbon content, grassland was estimated to hold approximately 32.4% of topsoil carbon stocks. The smallest amounts of carbon were found in arable/horticultural soils (Ostle *et al.*, 2009).

78. Carbon in live vegetation is estimated to account for five percent or less of the UK land carbon stock, of which forests and woodland (including natural woodland and

plantations) account for approximately 80% (Ostle *et al*., 2009). An Ecosystem Services Assessment has been produced as part of the ES (Chapter 22 Onshore Ecology Appendix 22.10 Ecosystem Services Assessment), and therefore ecosystem services are not considered further in this chapter.

21.6.5 Environment Stewardship Schemes

79. Environmental Stewardship Schemes (ESS) provide funding and advice to farmers, tenants and other land managers to encourage effective environmental management of land (Natural England, 2015). ESS were a key tool for the delivery of the Rural Development Programme for England 2007-2013, funded by the European Union and UK Government. The 2014-2020 Rural Development Programme of England attempts to build on and enhance the ESS by providing funding to protect 14,000ha of woodland and targeting specific biodiversity and water objectives (European Commission, 2017). The schemes are administered by Natural England for Defra.

80. There are three levels to the scheme:

- Entry Level Stewardship (ELS) – includes Uplands ELS (UELS): simple and effective land management agreements with priority options;
- Organic (OELS) – includes Uplands OELS: organic and conventional mixed farming agreements; and
- Higher Level Stewardship (HLS): more complex types of management and agreements tailored to local circumstances.

81. There are 1,629 land management agreements in rural Norfolk supported by agri-environment schemes on 176,277.56Ha (Natural England, 2017).

82. The total percentage of land signed up to the ESS crossed by the onshore project area is 0.09% of all ESS in Norfolk as a whole.

83. The location of the ESS agreements within the onshore project area is shown in Figure 21.5.

84. The onshore project substation and National Grid substation extension including overhead line modification is not situated on land subject to any ESS, however the onshore cable route crosses Entry Level (34.13, 6.4% of the onshore project area) and Entry Level plus Higher Level (117.8ha, 24.1% of the onshore project area) Stewardship Scheme agreements and therefore elements of the construction, operation and decommissioning of the onshore cable route such as trenching, cable installation and link boxes that could potentially impact on land under an ESS agreement will be considered.

21.6.6 Injurious Weeds and Invasive Plant Species

85. The Phase 1 habitat survey recorded two non-native invasive species listed on the Wildlife and Countryside Act 1981 Schedule 9. These were Japanese knotweed *Fallopia japonica* and Giant Hogweed *Heracleum mantegazzianum*. These were recorded at TG 20026 28956 and TF 90572 09388 respectively. These are shown on Figure 22.5 in Chapter 22 Onshore Ecology.

86. Japanese knotweed records were also identified through a biological records check[5], which show it to be found at the following locations:

- TG2006428426 - Drabblegate, Aylsham;
- TG3409431895 - Mill Common Road, North Walsham; and
- TG20082848 - Drabblegate, Aylsham.

21.6.7 Utilities

87. There are a number of utilities that are located along the onshore cable route, as identified by a commissioned utilities search undertaken in 2017 and updated in 2018 by engineering consultants GHD (Figure 21.6[6]). These include major and minor (domestic) utilities, with domestic utilities often being routed under the public highway.

88. The majority of the identified utilities crossing the onshore cable route are related to domestic services for gas, electricity, water and sewerage connections, including the buried high pressure gas pipeline running from the Bacton terminal heading overland to the west and south west. Sheringham Shoal Offshore Wind Farm underground cables (from Saxthorpe to Cawston) and Dudgeon Offshore Wind Farm underground cables (from Great Ryburgh to Necton) run through the onshore cable route.

89. The Dudgeon Offshore Wind Farm underground cable route comes into the Necton National Grid substation from the north west.

90. Table 21.13 provides information of the utilities of major and national importance that cross the onshore project area.

Table 21.13 Major utilities located within the onshore project area

Utility type	Provider
Gas	BPA, CADENT, National Grid UK
Telecoms	BT Telecoms, Vodafone, Virgin Media

[5] Due to copyright reasons, biological records cannot be reproduced in a figure.
[6] It is acknowledged that Ørsted are developing the Hornsea Project Three Offshore Wind Farm. This project is considered under the CIA and is therefore not part of the existing utilities baseline for Norfolk Vanguard.

Utility type	Provider
Electricity	National Grid UK, Dudgeon Offshore Wind Ltd, Sheringham Shoal Offshore Wind Ltd, UKPN
Water and Sewage	Anglian Water
Drainage	WMA

Source: compiled by GHD Ltd (2018).

21.6.8 Open Access and Common Land

91. Under the CRoW Act 2000 the public are not restricted to paths, but can freely walk on mapped areas of mountain, moor, heath, downland and registered common land, known as open access land.

92. There are no areas of open access land within the footprint of the onshore project area, however small areas of open access land are found adjacent to the onshore cable route, at Bacton Wood, near Hoveton along the A140 and along the River Wensum.

93. Open access and common land are considered further in Chapter 30 Tourism and Recreation and are therefore not considered further in this chapter.

21.6.9 Anticipated Trends in the Baseline Environment

94. The baseline review of land use and agriculture in section 21.6 shows that the predominant land use in the area of the project is arable or mixed use agricultural, with some areas of improved or semi-improved grassland, mixed deciduous woodland, coniferous plantations, hedgerows and waterbodies.

95. Chapter 22 Onshore Ecology notes that species associated with farmland environments have declined over the short and long term, with farmland birds and butterflies both declining, whilst mammal (bats) numbers increased from 1999-2015, but the increase has levelled out from the period 2010-2015 (Defra, 2017).

96. Soil erosion is expected to occur naturally over time, depending on weather conditions (exacerbated by climate change) and farming practices. With Norfolk aiming to position itself as a world class research base for innovative agricultural technology, driving improvements in water, energy and nutrient supply, it is hoped that food productivity will increase and address the issues and opportunities cited by Norfolk's Rural Development Strategy (resource pressures, the growth of the knowledge economy, climate change, an ageing and wealthier population and advances in industry and communications). The overall aim of the Strategy is to develop the economy whilst strengthening the relationship between rural and urban areas in a sustainable way, promoting green infrastructure and the protection of biodiversity.

97. Consequently, the quality and availability of agricultural land could reasonably be expected to decline over time, with some potential offsets by advances in agricultural innovations and technology.

21.7 Potential Impacts

98. This section outlines potential impacts as a result of the project and their significance, using the assessment methodology described in section 21.4 and Chapter 6 EIA Methodology. As the construction of the onshore project substation will potentially have different impacts in terms of type and magnitude than those associated with the onshore cable route, the magnitude of these are discussed separately under the same impact where relevant, however the greater of the two magnitudes is used to define the significance of that impact overall.

99. Chapter 5 Project Description provides full details of the activities proposed during the construction phase. However, the following activities have the potential to impact land use and agriculture:

- Pre-construction works including modification to existing drainage systems, road modifications, hedge and tree netting/removal, ecological preparations and archaeological surveys;
- Creation of temporary mobilisation areas to support duct installation;
- Creation of temporary works areas to support trenchless crossings;
- Excavation and installation of ducts including establishment of a running track and stockpiling of topsoil and subsoil within the cable route and subsequent disposal of excess topsoil or subsoil offsite to a suitable licenced facility;
- Installation of onshore cable systems by establishing joint pit locations and pulling cables through ducts including re-use of excavated soil in jointing bays;
- Construction of onshore project substation, with associated infrastructure and landscaping;
- Construction of Necton National Grid substation extension, with associated infrastructure and landscaping; and
- Temporary upgrade of access tracks and construction of new access tracks; as required.

100. Chapter 5 Project Description also provides details of the operation of the project. Impacts may occur as a result of permanent above ground infrastructure during the operation of the project (onshore project substation and National Grid substation extension).

21.7.1 Embedded Mitigation

101. Norfolk Vanguard Ltd has committed to a number of techniques and engineering designs/modifications inherent as part of the project, during the pre-application

phase, in order to avoid a number of impacts or reduce impacts as far as possible. Embedding mitigation into the project design is a type of primary mitigation and is an inherent aspect of the EIA process.

102. A range of different information sources has been considered as part of embedding mitigation into the design of the project (for further details see Chapter 5 Project Description, Chapter 4 Site Selection and Assessment of Alternatives and the Consultation Report (document reference 5.1)) including engineering requirement, feedback from community and landowners, ongoing discussions with stakeholders and regulators, commercial considerations and environmental best practice.

103. The following sections outline the key embedded mitigation measures relevant for this assessment. These measures are presented in Table 21.14.

104. Where embedded mitigation measures have been developed into the design of the project with specific regard to land use and agriculture, these are described in Table 21.15. The impact assessment presented in sections 21.7.5 to 21.7.7 takes into account this mitigation embedded into the project.

Table 21.14 Embedded mitigation

Parameter	Mitigation measures embedded into the project design	Notes
Strategic approach to delivering Norfolk Vanguard and Norfolk Boreas	Subject to both Norfolk Vanguard and Norfolk Boreas receiving development consent and progressing to construction, onshore ducts will be installed for both projects at the same time, as part of the Norfolk Vanguard construction works. This would allow the main civil works for the cable route to be completed in one construction period and in advance of cable delivery, preventing the requirement to reopen the land in order to minimise disruption. Onshore cables would then be pulled through the pre-installed ducts in a phased approach at later stages. In accordance with the Horlock Rules, the co-location of Norfolk Vanguard and Norfolk Boreas onshore project substations will keep these developments contained within a localised area and, in so doing, will contain the extent of potential impacts.	The strategic approach to delivering Norfolk Vanguard and Norfolk Boreas has been a consideration from the outset.
Commitment to HVDC technology	Commitment to HVDC technology minimises environmental impacts through the following design considerations; • HVDC requires fewer cables than the HVAC solution. During the duct installation phase this reduces the cable route working width (for Norfolk Vanguard and Norfolk Boreas combined) to 45m from the previously identified worst case of 100m. As a result, the overall footprint of the onshore cable route required for the duct	Norfolk Vanguard Limited has reviewed consultation received and in light of the feedback, has made a number of decisions in relation to the project design. One of these decisions is to deploy HVDC technology as the export system.

Parameter	Mitigation measures embedded into the project design	Notes
	installation phase is reduced from approx. 600ha to 270ha; • The width of permanent cable easement is also reduced from 54m to 20m; • Removes the requirement for a CRS; • Reduces the maximum duration of the cable pull phase from three years down to two years; • Reduces the total number of jointing bays for Norfolk Vanguard from 450 to 150; and • Reduces the number of drills needed at trenchless crossings (including landfall).	
Site Selection	The project has undergone an extensive site selection process which has involved incorporating environmental considerations in collaboration with the engineering design requirements. Considerations include (but are not limited to) adhering to the Horlock Rules for onshore project substations and National Grid infrastructure, a preference for the shortest route length (where practical) and developing construction methodologies to minimise potential impacts. Key design principles from the outset were followed (wherever practical) and further refined during the EIA process, including; • Avoiding proximity to residential dwellings; • Avoiding proximity to historic buildings; • Avoiding designated sites; • Minimising impacts to local residents in relation to access to services and road usage, including footpath closures; • Utilising open agricultural land, therefore reducing road carriageway works; • Minimising requirement for complex crossing arrangements, e.g. road, river and rail crossings; • Avoiding areas of important habitat, trees, ponds and agricultural ditches; • Installing cables in flat terrain maintaining a straight route where possible for ease of pulling cables through ducts; • Avoiding other services (e.g. gas pipelines) but aiming to cross at close to right angles where crossings are required; • Minimising the number of hedgerow crossings, utilising existing gaps in field boundaries; • Avoiding rendering parcels of agricultural land inaccessible; and • Utilising and upgrading existing accesses where possible to avoid impacting undisturbed ground.	Constraints mapping and sensitive site selection to avoid a number of impacts, or to reduce impacts as far as possible, is a type of primary mitigation and is an inherent aspect of the EIA process. Norfolk Vanguard Limited has reviewed consultation received to inform the site selection process (including local communities, landowners and regulators) and in response to feedback, has made a number of decisions in relation to the siting of project infrastructure. The site selection process is set out in Chapter 4 Site Selection and Assessment of Alternatives.
Duct Installation	The onshore cable duct installation strategy is	This has been a project

Parameter	Mitigation measures embedded into the project design	Notes
Strategy	proposed to be conducted in a sectionalised approach in order to minimise impacts. Construction teams would work on a short length (approximately 150m section) and once the cable ducts have been installed, the section would be back filled and the top soil replaced before moving onto the next section. This would minimise the amount of land being worked on at any one time and would also minimise the duration of works on any given section of the route.	commitment from the outset in response to lessons learnt on other similar NSIPs. Chapter 5 Project Description provides a detailed description of the process.
Long HDD at landfall	Use of long HDD at landfall to avoid restrictions or closures to Happisburgh beach and retain open access to the beach during construction. Norfolk Vanguard Limited have also agreed to not use the beach car park at Happisburgh South.	Norfolk Vanguard Limited has reviewed consultation received and in response to feedback, has made a number of decisions in relation to the project design. One of those decisions is to use long HDD at landfall.
Trenchless Crossings	Commitment to trenchless crossing techniques to minimise impacts to the following specific features; • Wendling Carr County Wildlife Site; • Little Wood County Wildlife Site; • Land South of Dillington Carr County Wildlife Site; • Kerdiston proposed County Wildlife Site; • Marriott's Way County Wildlife Site / Public Right of Way (PRoW); • Paston Way and Knapton Cutting County Wildlife Site; • Norfolk Coast Path; • Witton Hall Plantation along Old Hall Road; • King's Beck; • River Wensum; • River Bure; • Wendling Beck; • Wendling Carr; • North Walsham and Dilham Canal; • Network Rail line at North Walsham that runs from Norwich to Cromer; • Mid-Norfolk Railway line at Dereham that runs from Wymondham to North Elmham; and • Trunk Roads including A47, A140, A149.	A commitment to a number of trenchless crossings at certain sensitive locations was identified at the outset. However, Norfolk Vanguard Limited has committed to certain additional trenchless crossings as a direct response to stakeholder requests.

Table 21.15 Embedded mitigation for land use and agriculture

Parameter	Mitigation measures for land use and agriculture	Notes
Agriculture	Land take has been minimised where possible, reducing sterile	n/a

Parameter	Mitigation measures for land use and agriculture	Notes
	land parcels, aligning with field boundaries and avoiding the BMV land.	
Drainage	An attenuation pond at the onshore project substation and National Grid substation extension will accommodate additional impermeable ground. Sufficient cable burial depth to minimise impact and interaction with drainage	Flood risk is considered further in Chapter 20 Water Resources and Flood Risk.

21.7.2 Monitoring

105. Post-consent, the final detailed design of the project and the development of the CoCP will refine the worst-case impacts assessed in this EIA. It is recognised that monitoring is an important element in the management and verification of the actual project impacts. The requirement for and appropriate design and scope of monitoring will be agreed with the relevant stakeholders and included within the CoCP and the Construction Method Statement (CMS) (DCO requirement 20) commitments prior to construction works commencing.

21.7.3 Worst Case

106. Chapter 5 Project Description details the parameters of the project using the Rochdale Envelope approach for the ES. This section identifies those parameters during construction, operation and decommissioning relevant to potential impacts on land use and agriculture.

107. It is anticipated that the Norfolk offshore zone will be further developed by Vattenfall Offshore Wind Ltd. to accommodate the Norfolk Boreas Offshore Wind Farm. Consideration has been made in the assessment such that the onshore cable route for Norfolk Vanguard accommodates ducts for the future Norfolk Boreas Offshore Wind Farm (with the exception of the landfall and the onshore 400kV cable route at the onshore project substation). This concept avoids reopening cable trenches, and also allows for the re-use of some shared infrastructure (such as mobilisation areas) and pre-construction works, thereby minimising overall impacts and disruption.

108. Table 21.16 summarises the worst case assumptions for land use and agriculture.

Table 21.16 Worst case assumptions

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Landfall			
Construction	Maximum drill length Temporary works	1,000m 6,000m^2	

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
	footprint Maximum temporary works duration	 20 weeks based on 7am-7pm normal working hours.	
HDD compounds	Maximum number and maximum land take for temporary HDD compounds	Assumes 2 at 3,000m^2 to support parallel drilling rigs	
Onshore cable route			
Construction	Method Maximum working width and length Cable installation maximum footprint Onshore cable route maximum footprint Gaps at hedgerow / other crossing points Hedgerows to be removed Running track excavated material Trench excavated material	Open cut trenching 45m and 60km 447,688m^2 2,700,000m^2 20m 165 108,000m^3 360,000m^3	Full reinstatement is assumed for the running track and trench excavated material post-duct installation and before cables are pulled through (with the exception of 110,400m^2 which will be displaced by stabilised backfill and require disposal). Mitigation by design with respect to hedgerows is already included in Chapter 5 Project Description. 20m gaps at hedgerows are indicative, depending on the angle of crossing. This width assumes that the onshore cable route bisects each hedgerow in a perpendicular fashion. In reality, some hedgerows will be crossed at an angle, therefore increasing the maximum width of the gap required up to a possible 25m. Cable installation footprints include the running track and joint bay (Norfolk Vanguard only). Hedgerows estimated based on 110 hedgerows surveyed within the onshore infrastructure plus a further 55 identified from the Norfolk Living Map and

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
			aerial photography taken in 2017. The final number of hedgerows to be removed will be determined during surveys of the unsurveyed areas post-consent when access becomes available.
Permanent joint pits	Maximum number and required dimensions	Assume 150 at 90m^2 and 2m deep each	Norfolk Vanguard only, spaced approximately one per circuit per 800m cable.
Mobilisation areas	Maximum number and required dimensions	Assumes 14 at 10,000m^2	
Trenchless launch and reception sites	Maximum number and maximum land take for trenchless launch and reception sites	Assumes 17 pairs at 7,500m^2 and 5,000m^2 respectively	
Decommissioning		Joint pits and ducts capped and sealed and left in situ	Where cables are in pre-installed ducts, cables may be extracted once de-energised.
Onshore project substation			
Construction	Maximum land take for temporary works area Maximum duration	20,000m^2 (200m x 100m) 30 months	Norfolk Vanguard only. Indicative construction window 24 months.
Operation	Maximum land take for permanent footprint	75,000m^2	
Decommissioning	No decision has been made regarding the final decommissioning policy for the onshore project substation, as it is recognised that industry best practice, rules and legislation change over time. However, the onshore project equipment will likely be removed and reused or recycled. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst case scenario, impacts as for the construction phase are assumed.		
National Grid extension and overhead line modification			
Construction	Maximum land take for temporary works area – substation extension Maximum land take for temporary works area – overhead line Maximum duration	67,500m^2 444,709m^2 30 months	Indicative construction window 24 months.
Operation	Maximum land take for substation extension permanent footprint Maximum land take for	49,300m^2 9,250m^2	Includes existing Necton National Grid substation area.

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
	overhead line permanent footprint		

21.7.4 Assessment Scenarios

109. Chapter 5 Project Description outlines the scenarios to be assessed in relation to the phasing of the works. The phasing of the construction works is as follows:

- The offshore project may be constructed as one or two phases and elements of the onshore construction would also be phased to reflect this;
- Pre-construction works (e.g. hedgerow clearance) for the onshore cable route to be conducted over a two year period, prior to duct installation.
- Cable ducts would be installed in one operation over two years, regardless of the offshore strategy;
- Cable pull through would be done in either one or two phases;
- The onshore project substation s ground preparation and enabling works would be done in one phase, anticipated to take two years for pre-construction works and two years for primary works;
- The required electrical infrastructure and plant within the onshore project substation would then be installed as required for each phase if the one or two phase options were adopted for offshore construction; and
- Total construction window for the one phase scenario is anticipated to be five years, and six years for the two phase scenario.

110. In all cases for land use and agriculture, the two phase option is assumed to be the worst case, due to the increased length of time that receptors such as agricultural land, soils and drainage will be potentially impacted by the project.

21.7.5 Potential Impacts during Construction

21.7.5.1 Impact 1: Drainage

111. The excavation of the cable trenches, earthworks associated with onshore project substation construction, and the excavation and stockpiling of soils has the potential to cause an adverse impact to the natural and artificial field drainage systems during construction works. Existing field drains are likely to be at a depth of between 0.5m – 1.5m, and are expected to be made of ceramic, plaster or other materials. Field drains would be expected to be impacted by any excavation works planned through agricultural fields. It will be necessary to truncate the drainage systems temporarily during excavation and installation, followed by reinstatement after construction. More information regarding the local drainage system is provided in Chapter 20 Water Resources and Flood Risk.

21.7.5.1.1 Landfall and onshore cable route

112. Soil types found along the onshore cable route and at the landfall are mostly freely draining acidic, loamy soils, however the presence of field drainage networks, some of which are unmapped and informal, are considered to have a medium sensitivity overall, as they have a limited capacity to accommodate changes such as degradation or poor reinstatement of drainage systems (Table 21.5). Without mitigation the magnitude of the effect is considered to be low, due to the short term (less than five year) loss of soil and associated drainage, as land drains will only potentially be disrupted during the duct installation phase in a single two year operation.

21.7.5.1.2 Onshore project substation (including the National Grid substation extension and overhead line modification)

113. At the onshore project substation and National Grid substation extension including overhead line modification, any existing field drainage would be taken out of use during construction.

114. Without mitigation the magnitude of the effect is considered to be low, due to >20ha of soil and associated drainage being temporarily unsuitable in the short term (less than five year) for agriculture, as land drains will only potentially be disrupted during the installation of the onshore project substation electrical plant installation and National Grid overhead line modifications in a single two year operation.

21.7.5.1.3 Impact significance

115. Without mitigation, the greatest effect arising from the project is of low magnitude due to the scale and timing of the works (short term loss of > 20ha), on a medium sensitivity receptor, resulting in an impact of **minor adverse** significance.

116. Proposed mitigation measures therefore include maintaining/reinstating land drainage systems following construction, the provision of an ALO and a local specialised drainage contractor (to undertake surveys and create drawings pre- and post-construction, to locate drains and ensure appropriate reinstatement), the implementation of the final CoCP and SMP which would include provisions for a pre-construction Drainage Plan to minimise water within the trench and ensure ongoing drainage of surrounding land , in order to avoid any material change to the soil resource and reduce the magnitude of the effect to negligible. The SMP would include construction method statements for soil handling, would be produced by a competent soil science contractor and agreed with the relevant regulator, in advance of the works. This would be completed pre-construction once an earthworks contractor has been appointed and detailed earthworks phasing information is available. The contractor would be required to comply with the SMP, included in the CoCP (DCO requirement 20).

117. Best practice soil handling would be implemented during the pre-construction and construction phases to prevent the spread of plant and animal diseases, including following the Environment Agency (EA) (2010) guidance: Managing Invasive Non-native Plants.

118. Measures contained in relevant Defra and EA best practice guidance on the control and removal of invasive weed species would be implemented during the pre-construction and construction phases. A pre-construction land survey would be undertaken by a qualified Agricultural Liaison Officer (ALO) to record details of crop regimes, position and condition of field boundaries, existing drainage and access arrangements, and private water supplies.

119. The construction footprint has been minimised as far as practicable (see Chapter 5 Project Description). Land would be reinstated to its pre-construction condition as soon as reasonably possible following duct installation (and subsequently in isolated sections for cable installation), dependent on weather conditions and excluding permanent infrastructure (onshore project substation, link box locations and National Grid substation extension and overhead line modification).

120. At locations where the onshore cable route crosses existing drains, the running track would be installed over a pre-installed culvert pipe or other temporary bridging to allow continued access to the onshore cable route during construction. The pipe would be installed in the drain bed so as to avoid upstream impoundment, and would be sized to accommodate reasonable 'worst-case' water volumes and flows.

121. Where drains are shallower than 1.5m, temporary damming, culverting or diverting may be employed, with agreement from relevant internal drainage boards and flood management agencies.

122. The cable circuits would nominally be installed in a flat formation (each cable core installed alongside each other) to a minimum depth of 1.05m, in a trench of approximate 1m width. This depth would allow the cables (and protective tiles and tape) to be laid below the level of typical field drainage pipes and other underground services to minimise impact and interaction.

123. The mitigation measures would be dependent upon the field by field characteristics of soils, weather conditions, existing drainage arrangements and crops grown. Land drainage reinstatement techniques are well established and are often required periodically within agricultural land as part of general maintenance requirements.

124. This additional proposed mitigation is expected to reduce the residual impact to **negligible**.

21.7.5.2 Impact 2: Land taken out of existing use/disruption to agricultural activities

125. Land would either be taken out of existing use or isolated due to construction activities and effectively taken out of use. This would result in loss of a growing season in the area affected for each farmer (plus possible severance) and the loss of associated income.

21.7.5.2.1 Landfall and onshore cable route

126. Table 21.16 shows the total construction land take area based on worst case assumptions. At the landfall this is anticipated to be 6,000m^2 and for the onshore cable route 2,700,000m^2 during duct installation and 447,688m^2 for the cable installation.

127. The area of land that would need to be excluded from landowners, occupiers or the public has been minimised through a comprehensive route selection process as described in Chapter 4 Site Selection and Assessment of Alternatives, through extensive consultation with landowners and through the selection of HVDC technology. Access for farm vehicles to land severed by the works would be maintained wherever practicable in consultation and subject to individual agreements with landowners and occupiers. Where necessary, crossing points would be agreed pre-construction to minimise severed areas of land.

128. At this stage it is not possible to calculate the area of land that would become isolated or inaccessible, as access to individual fields would be determined as part of detailed design and construction planning. During construction, it is unavoidable that some accesses may become restricted, however during detailed design, efforts will be made to limit access restriction, and avoid isolating large parcels of land.

129. Based on the information provided in section 21.6, the majority of the construction footprint would be within areas currently associated with agricultural production.

130. Temporary land take would result from the footprint of mobilisation areas, onshore cable route (trenching, running track, soil storage) and jointing pit locations, as well as the entry and exit pit and temporary compounds associated with HDD at the landfall and trenchless construction techniques along the onshore cable route, much of which would be agricultural land taken temporarily out of use.

131. The predominant impacts in relation to land take would come during the two years of duct installation for the landfall and onshore cable route.

132. Where possible, reinstatement of hedgerows and their associated features (banks and ditches) to previous conditions as far as reasonably possible would occur following the duct installation phase. Removal of trees or interference with roots would be avoided where possible (for further details see Chapter 22 Onshore

Ecology). The exact timing and duration of works at any location are not known at this time.

133. The sensitivity of the receptor is considered to be medium, because the quality of the land varies from ALC grades 2 – 4, but 50% of the land area is ALC grade 3. The magnitude of effect is considered to be medium, based on the length of construction and the temporary nature of the effect (not extending past construction), with only temporary restriction to agricultural activities.

134. During construction it is unavoidable that land along the onshore cable route would temporarily be taken out of its existing land use, however the embedded mitigation measures, (see Table 21.14) reduce the potential impacts as far as practicable. Loss of ecological features such as hedgerows and trees are considered further in Chapter 22 Onshore Ecology, where mitigation is provided.

21.7.5.2.2 Onshore project substation

135. The onshore project substation works will lead to at most a temporary loss of approximately 9.5ha of arable land for the duration of the construction phase (worst case 30 months).

136. The sensitivity of the receptor is considered to be low, because of the scale of the works. The magnitude of effect is considered to be medium, based on the length of construction with temporary restriction to agricultural activities.

21.7.5.2.3 National Grid substation extension and overhead line modification

137. Work at the National Grid substation extension will result in a temporary loss of approximately 30ha of arable land for the duration of the construction phase (worst case 30 months).

138. The sensitivity of the receptor is considered to be medium, because the quality of the land varies from ALC grades 2 – 3. The magnitude of effect is considered to be medium, based on the length of construction with temporary restriction to agricultural activities.

21.7.5.2.4 Impact significance

139. Without mitigation, the greatest magnitude of effect arising from one element of the onshore infrastructure is medium magnitude, on a medium sensitivity receptor, resulting in an impact of **moderate adverse** significance.

140. Mitigation is therefore proposed. Potentially affected landowners have been consulted on as part of the project, and there will be ongoing consultation as required through the post-consent and detailed design phase, prior to construction.

141. Access for farm vehicles to land severed by the works would be maintained wherever practicable in consultation and subject to individual agreements with

landowners and occupiers. Where necessary, crossing points would be agreed pre-construction.

142. Where land area is separated by the works, access for farm vehicles would be maintained where practical, in consultation with individual landowners and occupiers. Where necessary, crossing points would be agreed prior to construction.

143. Wherever practicable, appropriate planning and timing of works will be agreed with landowners and occupiers, subject to individual agreements, to reduce conflicts.

144. Private agreements (or compensation for in line with the compulsory purchase compensation code) will be sought between Norfolk Vanguard Limited and relevant landowners/occupiers regarding any measures required in relation to crop loss incurred as a direct consequence of the construction phase of the project. It is expected that these mitigation measures will reduce the predicted residual impact to **minor adverse**, as the risk associated with loss of land for agriculture and its associated usability and value will be reduced to a low magnitude.

21.7.5.3 Impact 3: Degradation of natural resources - soil

145. The following activities proposed during the construction phase have been identified as having the potential to degrade the existing soil resource:

- Intrusive pre-construction technical and environmental surveys;
- Removal of trees and vegetation;
- Topsoil stripping, earthworks and landscaping within the construction footprint;
- Construction and operation of the running track;
- Operation of the mobilisation areas;
- Storage of topsoil and subsoil; and
- Reinstatement of subsoil and topsoil.

146. There is the potential for soils to be compacted and soil structure to deteriorate during the works, especially along access routes, running tracks and where heavy materials or equipment is stored, as well due to changes to the local drainage (this is described in Chapter 20 Water Resources and Flood Risk). The result would be reduced biological activity, porosity and permeability and increased strength. It can also lead to reduced water infiltration capacity and increased risk of erosion (European Commission, 2008). The potential effect of these impacts is reduced fertility and crop yields, should the site be returned to agricultural use in the future.

147. If soils are not stored or reinstated correctly, or are compacted, there is potential to lose the definition of soil profiles, which can lead to homogenisation of the soil. Again, this may reduce fertility and crop yields if the soils are returned to agricultural use in the future. As well as the physical changes to the soil resource, there is also the potential to impact on the chemical, pH and organic content in soils.

148. Disturbance of soils may result in a loss of carbon, previously sequestered in the soil, to the atmosphere as a result of processes including microbial action. Carbon may be lost from soil as a result of physical disturbance (including disturbance during agricultural use such as ploughing) which breaks up soil aggregates and enhances oxygenation. It can also be lost due to construction activities, for example losses from the core of stockpiled soils through microbial decomposition. Land drainage or stockpiling can result in drying and decomposition of peaty layers. Spills and leaks of contaminative materials during construction can also adversely affect the soil quality.

149. The soils in the onshore project area are in general loamy and clayey and, therefore susceptible to compaction, and difficult to handle during wet periods using machinery without causing structural degradation. Given these characteristics, the soil resource at the site is conservatively considered to be of high sensitivity with respect to potential for degradation during the construction period.

150. Soil within the construction areas would be subjected to earthworks including initial stockpiling and movement between stockpiles. The magnitude of this potential effect is considered to be high.

21.7.5.3.1 Impact significance

151. Norfolk Vanguard Limited have sought to minimise the use or impact on natural resources as a result of the project. Impacts on the soil resource have been minimised through the sensitive siting of the landfall, onshore cable route and onshore project substation (avoiding where possible land take of the BMV soil and land under ESS), and through the selection of the HVDC technology, minimising the project footprint and thereby minimising the use of natural resources.

152. Measures outline in Table 21.14 would avoid any material change to the soil resource and aid in the recovery of the land, therefore the sensitivity of the receptor is low (some resistance to structural damage), and the magnitude of the effect is also low.

153. A range of mitigation measures are proposed to further reduce the effect of the construction activities on the soil resource. These include:

- Soils handling, storage and reinstatement by a competent contractor under Defra (2009) Construction code of practice for the Sustainable Use of Soils on Construction Sites.
- Topsoil stripping within all construction areas and storage adjacent to where it is extracted, where practical.
- Storage of the excavated subsoil separately from the topsoil, with sufficient separation to ensure segregation.

- Handling of soils according to their characteristics - e.g. within wooded areas it is unlikely that topsoil resources of any quality could be separated and preserved for reuse. If current wooded areas are to be used for storage it would not be necessary to undertake topsoil stripping. Topsoil from agricultural land may be treated as a single resource for stockpiling and reuse.
- Where necessary, tree roots would be removed by screening.
- Where under storage areas, loosening of subsoils is proposed when dry to improve permeability before the topsoil is replaced.
- For most after-uses, subsoils may be treated as a single resource for stockpiling;
- During wet periods, limiting mechanised soil handling in areas where soils are highly vulnerable to compaction.
- Restricting movements of heavy plant and vehicles to specific routes and avoidance of trafficking of construction vehicles in areas of the site which are not subject to construction phase earthworks.
- Minimising the excavation footprint where possible.
- In circumstances where construction has resulted in soil compaction, further remediation may be provided, through an agreed remediation strategy.

154. These measures outlined above would be set out in a SMP, including construction method statements for soil handling, which would be produced by a competent soil science contractor and agreed with the relevant regulator in advance of the works. This would be completed pre-construction once an earthworks contractor has been appointed and detailed earthworks phasing information is available. The contractor would be required to comply with the SMP.

155. Private agreements (or compensation in line with the compulsory purchase compensation code) will be sought between Norfolk Vanguard Limited and relevant landowners/occupiers regarding any measures required in relation to crop loss incurred as an indirect consequence of degradation of the soil resource during the construction phase of the project. This is expected to reduce the residual impact to **negligible**.

21.7.5.4 Impact 4: Loss of soil resource – erosion

156. In certain weather conditions, some soil types can be susceptible to erosion during excavation, storage or following reinstatement. Given the relatively cohesive nature of the soil resource identified within the construction footprint (clayey loams), it is not considered that the soils would be highly vulnerable to this effect and the sensitivity of the soils to erosion is considered to be of low sensitivity.

157. The project would require excavation during construction for the onshore cable route, landfall and onshore project substation. The potential magnitude of the effect is, therefore, predicted to be medium, due to the medium to long term (5-10 years) loss of more than 20ha of the BMV agricultural land (ALC grades 1 and 2).

21.7.5.4.1 Impact significance

158. Prior to additional mitigation, the greatest magnitude arising from one element of the onshore infrastructure is medium magnitude, on a low sensitivity receptor, resulting in an impact of **minor adverse** significance.

159. Mitigation measures are therefore proposed to reduce any effects from loss of soil resource by erosion include adherence to the MAFF (2000) Good Practice Guide for Handling Soils and Defra (2009) Construction code of practice for the Sustainable Use of Soils on Construction Sites. These recommend:

- Only working in appropriate weather conditions where soil type dictates;
- Appropriate soil storage;
- Maintaining effective drainage systems during construction; and
- Ensuring reinstatement of individual areas occurs as soon as practicable after construction. Planting vegetation shortly afterwards.

160. These mitigation measures would be captured in a SMP that the contractor would be required to comply with, which will employ best practice techniques to protect the soil resource.

161. A commitment will be made within the private agreements between Norfolk Vanguard Limited and the landowner/occupier to compensate for crop loss incurred as an indirect consequence of soil erosion during the construction phase of the project. It is expected that this will reduce the predicted residual impact to **negligible**, as the risk associated with loss of land for agriculture and its associated usability and value will be reduced to a low magnitude.

21.7.5.5 Impact 5: Impact to ESSs

162. During the construction period there would be the potential for impacts on ESS within the onshore project area. The effect on individual landowners / occupiers is likely to be specific to their own scheme, which would need to be discussed between Norfolk Vanguard Limited, landowners, occupiers and Natural England prior to construction. The impacts could range from the agreement ceasing entirely to no impact on the agreement, depending on the agreement objectives and location of the works. As such, this assessment looks at the impacts in general terms rather than on an agreement by agreement basis. Two potential connected impacts are anticipated as a result of construction:

- Ecological – in terms of the loss of the agreements and the substantive agri-environmental objectives of the scheme; and
- Financial – in terms of the loss of the agreements and the impact on overall farming income (this would be addressed via private agreements).

163. Following the completion of construction, all areas subject to ESS would be reinstated (see Chapter 22 Onshore Ecology) and it is likely that the same or similar agreements would be reinstated following construction.

21.7.5.5.1 Landfall and onshore cable route

164. During construction, there would be the potential for impacts from the onshore cable route on ESS, as described above.

165. Ecological features that are likely to be subject to agreements, such as trees and ponds, have been avoided where practicable. A number of rivers, ditches and hedgerows would be crossed; however, these would be crossed at right angles where possible/practicable to minimise disturbance to those features, and replanted / reinstated following completion of the works. A number of sensitive features such as certain rivers will be crossed using trenchless techniques (e.g. HDD).

166. The onshore cable route crosses Entry Level (34.13ha, 6.4% of onshore project area) and Entry Level plus Higher Level (117.8ha, 22.2% of onshore project area) Stewardship Scheme agreements.

167. There is potential for a certain amount of disruption to ESS as a direct result of loss of land during the construction affecting such features as field margins. A number of landowners within an ESS would be affected by the project. The total land with an ESS agreement crossed by the onshore project area is 0.05% of ESS in Norfolk as a whole. The sensitivity of receptors is considered to be medium, as there are no Higher Level Stewardship Scheme agreements in place. It is considered that the overall magnitude of effect would be negligible at a county scale, due to the area affected, the extent of agreements within the onshore cable route, and the nature of the ESS.

21.7.5.5.2 Onshore project substation (including the National Grid substation extension and overhead line modification)

168. The onshore project substation and the National Grid substation extension including overhead line modification do not include any ESS and therefore **no impact** is predicted.

21.7.5.5.3 Impact significance

169. Prior to mitigation, the greatest magnitude arising from one element of the onshore infrastructure is of negligible magnitude, on a medium sensitivity receptor, resulting in an impact of **minor adverse** significance.

170. A commitment will be made within the private agreements between Norfolk Vanguard Limited and the landowner/occupier to compensate for losses incurred due to potential impacts on ESS during the construction phase of the project. This is expected to reduce the predicted impact to **negligible**.

21.7.5.6 Impact 6: Utilities

21.7.5.6.1 Landfall, onshore cable route, onshore project substation including the National Grid substation extension

171. Potentially affected utility providers have been consulted on as part of the project, and there will be ongoing consultation as required through the post-consent and detailed design phase, prior to construction.

172. Norfolk Vanguard Limited would undertake utility crossings in accordance with industry standard practice as agreed with the utility owners.

173. The continuity of water supplies during the construction works would be ensured. The onshore cable route has been selected to avoid major utilities where possible/practicable. Therefore, **no impacts** associated with existing utilities are anticipated during construction.

21.7.6 Potential Impacts during Operation

174. This section describes the potential impacts arising during the operational phase of the project. Reference should also be made to Chapter 5 Project Description for full details of the operational phase.

21.7.6.1 Impact 1: Drainage

21.7.6.1.1 Onshore project substation, National Grid substation extension, landfall and onshore cable route

175. Land drains are present throughout the onshore project area. The mitigation measures outlined in section 21.7.5.1 would ensure the impact on land drainage is minimised.

176. The potential drainage requirements and strategy for minimising flood risk at the onshore project substation are discussed in Chapter 20 Water Resource and Flood Risk.

177. All drainage would be reinstated and drainage requirements at the onshore project substation would be compliant with the Flood Risk Assessment (FRA) (Chapter 20 Water Resources and Flood Risk Appendix 20.1).

21.7.6.1.2 Impact significance

178. Due to the reinstatement of all drainage post construction and adherence with the FRA, **no impact** is predicted during operation.

21.7.6.2 Impact 2: Permanent change to land use

179. A permanent easement has been sought by Norfolk Vanguard Limited directly over the cables. The easement would restrict activities which would penetrate the

ground by more than 0.65m. As such, it is expected that normal agricultural activities would be able to continue.

180. Routine maintenance is anticipated to consist of one annual visit to each link box (approximately every 5 km) to carry out routine integrity tests, which would be accessed via the cabinets or by the manhole covers.

181. Appropriate off-road vehicles would be used to access each link box, and link boxes would be located adjacent to field boundaries or roads as far as possible.

182. Non-scheduled maintenance/repairs to address faults as and when these may arise would also be necessary, and this maintenance/repair could be required anywhere along the onshore cable route.

21.7.6.2.1 Landfall and onshore cable route

183. The areas of land that would be affected by permanent easement restrictions have been minimised through the robust route selection process as described in Chapter 4 Site Selection and Assessment of Alternatives.

184. It is anticipated that non-scheduled maintenance events would be highly localised, temporary and of short duration.

185. In order to facilitate access to link boxes, these would be located, where possible, adjacent to field boundaries (avoiding root zone) or roads and appropriate off-road vehicles would be used to access each of these.

186. In terms of potential impacts to the root growth zone, any impacts would be highly localised, immediately surrounding the cables / ducts themselves. If required, a rapid reconnaissance at selected locations along the route could be undertaken post construction. Visual indicators of poor crop performance (relative to surrounding areas outside the onshore cable route) can be used to assess potential damage which may then be investigated in further detail. Should potential issues be raised, these would be investigated and remediation strategies agreed and implemented where appropriate. Continuous monitoring would then be employed where necessary.

187. Discussions with landowners regarding potential future land uses and any restrictions on these (for example there may be restrictions on construction or planting e.g. trees or hedgerows on or within a certain distance from the onshore cable easement) would be undertaken as part of ongoing discussions between landowners and Norfolk Vanguard Limited.

188. The sensitivity of the receptor is considered to be medium, because the quality of the land varies from ALC grades 2 – 4, but 50% of the land area is ALC grade 3. The

magnitude of the effect is considered to be negligible due to the small area of land affected and the temporary nature of the impact (i.e. only when access is required).

21.7.6.2.2 Onshore project substation

189. The total permanent land take for the footprint of the onshore project substation is approximately 7.5ha according to the worst case scenario (Table 21.16). Additional land is also required for planting/screening, as detailed in Chapter 29 Landscape and Visual Impact Assessment. The onshore project substation is proposed on land classified as ALC grade 3, which is considered to be of medium sensitivity. The land would be taken out of use permanently. Whilst the onshore project substation at a local, field boundary level is a large size, in the context of the county resource and the potential impacts to agricultural productivity (as outlined above in section 21.6.3), the magnitude is considered to be low.

21.7.6.2.3 National Grid substation extension zone

190. Total permanent land take to accommodate works in the National Grid substation extension zone is approximately 3ha. Additional land is required for planting and screening as detailed in Chapter 29 Landscape and Visual Impact Assessment. The National Grid substation extension is proposed in ALC grade 2 and 3 land, and therefore considered to be of high sensitivity. The land would be taken out of use permanently. Due to the small area of the National Grid substation extension in the context of the regional resource (as outlined above in section 21.6.3), the magnitude is considered to be low.

21.7.6.2.4 Impact significance

191. Embedded mitigation measures have minimised impacts to the BMV land through the site selection process. Prior to additional mitigation, the greatest magnitude of effect arising from one element of the onshore infrastructure is low, as the total land take covered by the onshore project area accounts for 0.1% of county agricultural resource, on a receptor with a medium sensitivity. The impact significance is therefore predicted to be **minor adverse**.

192. Mitigation measures include the protection of the soil resource and reinstatement of land to previous conditions will be sought as far as reasonably possible through the CoCP and SMP. Private agreements will be sought between Norfolk Vanguard Limited and relevant landowners/occupiers regarding any permanent loss of land incurred as a direct consequence of the operation phase of the project. The predicted residual impact is expected to reduce to **negligible**.

21.7.6.3 Impact 3: ESSs

21.7.6.3.1 Landfall and onshore cable route

193. Following construction, it is expected that all land under an ESS within the onshore project area that has been affected would be reinstated. In terms of permanent infrastructure along the onshore cable route and at the landfall, there would be a total of 24 link boxes (2.25m^2 per link box under the worst case assumptions, which could potentially impact on land designated under an ESS. Link boxes would be located adjacent to field boundaries where possible. In terms of impacts to ESS this is considered to have a **negligible** impact due to the scale of the impact and that there are no Higher Level Stewardship Schemes along the cable route or at the landfall. Potential impacts regarding permanent easement are discussed in permanent changes to land use in section 21.7.6.2.

21.7.6.3.2 Onshore project substation including National Grid extension and overhead line modification

194. There are no ESSs at the onshore project substation, therefore **no impact** is predicted.

21.7.6.3.3 Impact significance

195. Without mitigation, the greatest magnitude of effect arising from one element of the onshore infrastructure is negligible, on a receptor with a medium sensitivity. The predicted impact is therefore **negligible**. No further mitigation is therefore proposed.

21.7.6.4 Impact 4: Utilities

196. The potential exists for maintenance activities to affect utilities, since these activities may require access to the buried cables. Utilities are considered to be highly sensitive, in particular electricity, gas and water, due to the potential disruption that could be caused should the services be disrupted.

21.7.6.4.1 Impact significance

197. As described in section 21.6.7, potentially affected utility providers would be contacted and the location of existing services would be identified prior to maintenance works to ensure there would be **no impact**.

21.7.7 Potential Impacts during Decommissioning

198. This section describes the potential impacts of the decommissioning of the onshore infrastructure with regards to impacts on land use and agriculture. Further details are provided in Chapter 5 Project Description.

199. No decision has been made regarding the final decommissioning policy for the onshore cables, as it is recognised that industry best practice, rules and legislation

change over time. It is likely the cables would be pulled through the ducts and removed, with the ducts themselves sealed and capped and left in situ.

200. In relation to the onshore project substation, the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology would be determined later within the project lifetime, but are expected to include:

- Dismantling and removal of outside electrical equipment from site located outside of the onshore project substation buildings;
- Removal of cabling from site;
- Dismantling and removal of electrical equipment from within the onshore project substation buildings;
- Removal of onshore project substation building and minor services equipment;
- Demolition of the support buildings and removal of fencing;
- Landscaping and reinstatement of the site (including land drainage); and
- Removal of areas of hard standing.

201. Whilst details regarding the decommissioning of the onshore project substation are currently unknown, considering the worst case scenario which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be similar or less than to those during construction.

202. The decommissioning methodology would need to be finalised nearer to the end of the lifetime of the project so as to be in line with current guidance, policy and legislation at that point. Any such methodology and associated mitigation would be agreed with the relevant authorities and statutory consultees. The decommissioning works could be subject to a separate licencing and consenting approach.

21.8 Cumulative Impacts

203. Potential cumulative impacts to land could arise from interaction with other developments within the vicinity of the onshore project area, either spatially or temporally. Given that the land use impacts of the project mostly affect receptors within the onshore project area, there is limited potential for interaction with any developments which do not have direct overlap with the project. With regard to land use receptors assessed in this chapter, a potential for cumulative impact would therefore only occur if those same receptors are directly affected. Whilst indirect impacts have been assessed in this chapter (at the wider regional scale e.g. several developments may affect drainage systems or ESS) these have been assessed as having no or negligible impact. The CIA for land use and agriculture therefore only assesses impacts and projects where a direct overlap occurs.

204. The assessment of cumulative impact has been undertaken here as a two stage process. Firstly, all the impacts from previous sections have been assessed for the potential to act cumulatively with other projects. This summary assessment is set out in Table 21.17.

Table 21.17 Potential cumulative impacts

Impact		Potential for cumulative impact	Rationale
Construction			
1	Drainage	Yes	Cumulative direct impacts arising from two or more projects are possible given the level of uncertainty regarding the presence and location of drainage systems. Impacts may occur to individual field drains in any area of overlap or those with an extent which intersects two or more proposed development boundaries (where groundworks are anticipated).
2	Land taken out of existing use	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect local productivity (e.g. loss of earnings from more than one project taking the same parcels of land out of use). Changes to ALC grades of land may also occur as an indirect impact.
3	Natural resource - soil	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect local productivity (e.g. loss of earnings from more than one project taking the same parcels of land out of use). Changes to ALC grades of land may also occur as an indirect impact.
4	Soil erosion	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect local productivity (e.g. loss of earnings from more than one project taking the same parcels of land out of use). Changes to ALC grades of land may also occur as an indirect impact.
5	ESSs	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect land under ESS (e.g. loss of earnings from ESS more than one project taking the same parcels of land out of use).
6	Utilities	No	Potentially affected utility providers would be contacted and the location of existing services would be identified prior to

Impact		Potential for cumulative impact	Rationale
			works to ensure there would be no impact.
Operation			
1	Drainage	No	Due to the reinstatement of all drainage post construction and adherence with the flood risk assessment, no cumulative impacts are predicted during operation.
2	Permanent change to land use	Yes	Cumulative impacts may occur at a county scale where impacts to productivity affect the wider agriculture industry.
3	ESS	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect land under ESS (e.g. loss of earnings from ESS more than one project taking the same parcels of land out of use).
4	Utilities	No	Potentially affected utility providers would be contacted and the location of existing services would be identified prior to works to ensure there would be no impact.
Decommissioning			
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be the same as those identified during the construction stage.			

205. The second stage of the CIA is an assessment of whether there is spatial overlap between the extent of potential effects of the onshore infrastructure and the potential effects of other projects scoped into the CIA upon the same receptors. To identify whether this may occur, the potential nature and extent of effects arising from all projects scoped into the CIA have been identified and any overlaps between these and the effects identified in section 21.7 have also been identified. Where there is an overlap, an assessment of the cumulative magnitude of effect is provided.

206. The projects identified for potential cumulative impacts with Norfolk Vanguard have been discussed during ETG meetings with stakeholders and the full list has been agreed in consultation with the relevant local authorities.

207. Table 21.18 summarises those projects which have been scoped in to the CIA due to their potential spatial overlap with the project or their potential to impact the same receptors. The remainder of the section details the nature of the cumulative impacts against all those receptors scoped in for cumulative assessment.

Table 21.18 Summary of projects considered for the CIA in relation to land use and agriculture

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Rationale
National Infrastructure Planning							
Norfolk Boreas Offshore Wind Farm	Pre-Application	Expected construction date 2026	0 – projects are co-located	Pre-application outline only	High	Yes	Overlapping proposed project boundaries may result in impacts of a direct and / or indirect nature during construction and operation.
Hornsea Project Three Offshore Wind Farm	Pre-Application	Expected construction date 2021	0 – cable intersects project	Full PEIR available: http://hornseaproject3.co.uk/Documents-library/PEIR-Documents	High	Yes	Overlapping proposed project boundaries at Reepham may result in impacts of a direct and / or indirect nature during construction and operation.
Dudgeon Offshore Wind Farm	Commissioned	Constructed	0	http://dudgeonoffshorewind.co.uk/	High	No	Due to the completion of the project, there are no potential direct or indirect potential cumulative impacts during construction. For operational impacts, the Dudgeon Offshore Wind Farm is part of the baseline in the main assessment (section 21.6), therefore no potential cumulative impacts are proposed.
A47 corridor improvement programme – North Tuddenham to Easton	Pre-application	Expected construction date 2021-23	2.5	https://infrastructure.planninginspectorate.gov.uk/projects/eastern/a47-north-tuddenham-to-easton/	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.

[7] Shortest distance between the considered project and Norfolk Vanguard – unless specified otherwise.

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Rationale
A47 corridor improvement programme – A47 Blofield to North Burlingham	Pre-application	Expected construction date 2021-22	25	https://infrastructure.planninginspectorate.gov.uk/projects/eastern/a47-blofield-to-north-burlingham/	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
A47 corridor improvement programme – A47 / A11 Thickthorn	Pre-application	Expected construction date 2020-21	18	https://infrastructure.planninginspectorate.gov.uk/projects/eastern/a47a11-thickthorn-junction/	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Norwich Western Link	Pre-application	2022	2.8	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/norwich/norwich-western-link/timeline	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Third River Crossing (Great Yarmouth)	Pre-application	Expected to start in 2020	28	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-yarmouth/third-river-crossing	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
King's Lynn B Power Station amendments	Pre-application	Expected construction	28	https://www.kingslynnbccgt.co.uk/	Medium	No	No direct overlap and therefore no potential cumulative impacts on the

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Rationale
		2018 - 2021					same receptors.
NNDC							
PF/17/1951 Erection of 43 dwellings and new access with associated landscaping, highways and external works, and amendments to substation)	Awaiting decision	Anticipated Q2 2018	0.7	Application available: https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_92323	High	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Bacton Gas Terminal Extension	Approved	Approved 20/09/2016. Expires 20/09/2019	3.0	Approved PDS available https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_88689	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Bacton Gas Terminal Coastal Protection	Approved	Approved 18/11/2016. Expires 18/11/2019	2.5	Approved PDS available	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Bacton and Walcott Coastal Management Scheme	Approved	Expected construction date 2018	1.0	Public information leaflets available: https://www.north-	Medium	No	Coastal protection scheme is restricted to the beach/intertidal area and therefore there are no

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Rationale
				norfolk.gov.uk/media/3371/bacton-to-walcott-public-information-booklet-july-2017.pdf			direct or indirect cumulative impacts anticipated.
Breckland Council							
21-31 new dwellings in Necton (BLR/2017/0001/PIP)	Awaiting decision	Not known. Application submitted November 2017.	1.0	http://planning.breckland.gov.uk/OcellaWeb/showDocuments?reference=BLR/2017/0001/PIP&module=pl	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
4-8 new dwellings in Necton (BLR/2017/0002/PIP)	Awaiting decision	Not known. Application submitted November 2017.	1.0	http://planning.breckland.gov.uk/OcellaWeb/showDocuments?reference=BLR/2017/0002/PIP&module=pl	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
70 dwellings (3PL/2016/0298/D) (Phase 2 of 3PL/2012/0576/O)	Approved (21/09/16)	Not known. Application submitted March 2016.	6.4	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2016/0298/D&from=planningSearch	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
98 dwellings at Swans Nest with access from Brandon Road (3PL/2017/1351/F) (Phase 3 of	Awaiting decision (due 30/03/2018)	Not known. Application submitted Jan 2016.	6.4	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2017/1351/F&from=planningSearch	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Rationale
3PL/2012/0576/O)							
175 dwellings with access at land to west of Watton Road, Swaffham (3PL/2016/0068/O) (Swans Nest Phase B)	Awaiting decision (due 13/10/2017)	Not known. Application submitted Jan 2016.	6.4	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2016/0068/O	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.

208. As identified in Table 21.18, through one of its subsidiaries, Vattenfall Wind Power Ltd is developing the Norfolk Boreas Offshore Wind Farm (herein the 'Norfolk Boreas project'). The offshore project area for Norfolk Boreas is located to the north of Norfolk Vanguard East, and the DCO submission for Norfolk Boreas is expected to follow approximately a year behind the Norfolk Vanguard DCO submission. The development of Norfolk Boreas will use the same onshore cable route as Norfolk Vanguard.

209. The worst case scenario for land use and agriculture is set out in section 21.7.2 has assumed that the laying of ducts for the onshore cable route for Norfolk Boreas project will be conducted as part of the Norfolk Vanguard project construction (as a worst case). Therefore, the elements of Norfolk Boreas that are considered in the CIA are the Norfolk Boreas cable pull and onshore project substation (including the National Grid substation extension, any landscaping or planting, and the onshore 400kV cable route).

210. In summary, the following projects will be assessed for potential direct cumulative impacts:

- Norfolk Boreas Offshore Wind Farm (elements identified in paragraph 209); and
- Hornsea Project Three.

211. To avoid confusion between different projects, the Norfolk Vanguard Offshore Wind Farm, previously referred to as 'the project', is referred to as 'the Norfolk Vanguard project' within this section.

21.8.1 Cumulative Impacts during Construction

21.8.1.1 Cumulative impact 1: Drainage

21.8.1.1.1 Norfolk Boreas and Hornsea Project Three

212. Due to geographical overlap between the Norfolk Vanguard project and Norfolk Boreas and Hornsea Project Three there is the potential for direct cumulative impacts upon drainage systems during construction.

213. As set out in section 21.7.5.1, impacts resulting in these potential effects as part of construction work are those associated with intrusive groundworks associated with the various projects, should they occur. The extent of any impact will depend on the presence and location of field drains. Any adverse effects would be temporary and reversible for the duration of construction. In the absence of mitigation, direct cumulative magnitude of effect on drains would be considered to be medium, resulting in an impact of **moderate adverse** significance**.**

214. However, both Norfolk Boreas and Hornsea Project Three are subject to EIA, and are therefore anticipated to adopt mitigation strategies which will seek to avoid, reduce or offset the effects of direct impacts upon drainage. For the Norfolk Vanguard project, these strategies include a specialist drainage contractor to locate and draw plans of drainage systems, pre-construction Drainage Plan, the temporary damming, culverting or diversion, and installing cables at a depth where they will be laid below the level of typical field drainage pipes to minimise impacts and interaction, which is expected to reduce the magnitude of effect from medium to low. Such strategies are considered highly likely to result in a residual impact of **minor adverse**.

21.8.1.2 Cumulative impact 2: Land taken out of existing use/disruption to agricultural practices

21.8.1.2.1 Norfolk Boreas

Cable installation

215. The construction of the Norfolk Vanguard project would lead to minor adverse impact on the land taken out of use. Impacts of cables pulled into pre-installed ducts for Norfolk Boreas would be negligible, therefore the cumulative impact of both projects is expected to remain as **minor adverse**.

Onshore project substation and National Grid substation extension

216. The co-location of the Norfolk Vanguard and Norfolk Boreas onshore project substations could lead to potential cumulative impacts, as the area of land taken out of agricultural use during construction would increase. The onshore project substation for Norfolk Vanguard would lead to a minor adverse impact on land taken out of use. The additional impact of the Norfolk Boreas substation would also create a **minor adverse** impact on land taken out of use.

217. Norfolk Boreas is subject to EIA, and is therefore anticipated to adopt mitigation strategies which will seek to avoid, reduce or offset the effects of direct impacts upon land take, therefore the cumulative impact of the two projects is considered to remain as **minor adverse** and no further mitigation is required.

21.8.1.2.2 Hornsea Project Three

218. Land taken out of use for Hornsea Project Three and the Norfolk Vanguard project where the cables intersect would be reinstated following construction, therefore **no impact** is predicted cumulatively for these two projects.

21.8.1.3 Cumulative impact 3: Degradation of natural resources - soil

21.8.1.3.1 Norfolk Boreas

219. The construction of the Norfolk Vanguard project would lead to minor adverse impact on the soil resource. Impacts of cables pulled into pre-installed ducts for

Norfolk Boreas would be negligible and therefore the cumulative impact of the two projects is considered to remain as **minor adverse**.

21.8.1.3.2 Hornsea Project Three

220. Land taken out of use for the Hornsea Project Three and the Norfolk Vanguard project where the cables intersect would be reinstated following construction, therefore **no impact** is predicted cumulatively for these two projects.

21.8.1.4 Cumulative impact 4: Loss of soil resource - erosion

21.8.1.4.1 Norfolk Boreas

221. The construction of the Norfolk Vanguard project would lead to minor adverse impacts. Impacts of cables pulled into pre-installed ducts for Norfolk Boreas would be negligible and therefore the cumulative impact of the two projects is considered to remain as **minor adverse**.

21.8.1.4.2 Hornsea Project Three

222. Land taken out of use for the Hornsea Project Three and the Norfolk Vanguard project where the cables intersect would be reinstated following construction, therefore **no impact** is predicted cumulatively for these two projects.

21.8.1.5 Cumulative impact 5: ESS

21.8.1.5.1 Norfolk Boreas

223. The construction of the Norfolk Vanguard project would lead to negligible impacts on ESS. Impacts of cables pulled into pre-installed ducts for Norfolk Boreas would be negligible.

224. The co-location of the Norfolk Vanguard project and Norfolk Boreas onshore project substations would lead to potential cumulative impacts, as the area of land taken out of agricultural use during construction would increase.

225. However, Norfolk Boreas is subject to EIA, and is therefore anticipated to adopt mitigation strategies which will seek to avoid, reduce or offset the effects of direct impacts upon land take. The cumulative impact of both projects is expected to remain as **negligible**.

21.8.1.5.2 Hornsea Project Three

226. Land taken out of use for the Hornsea Project Three and the Norfolk Vanguard project where the cables intersect would be reinstated following construction, therefore **no impact** is predicted cumulatively for these two projects.

21.8.2 Cumulative Impacts during Operation

21.8.2.1 Cumulative impact 2: Permanent change to land use

21.8.2.1.1 Norfolk Boreas and Hornsea Project Three

227. The land areas of the onshore project substation and National Grid substation extension for Norfolk Boreas and the Norfolk Vanguard project would be taken permanently out of use. This impact is minor adverse at the wider county level.

228. The development of Norfolk Boreas will use the same onshore cable route as Norfolk Vanguard, and would only affect land owners when access is required. The same situation is anticipated for Hornsea Project Three. Therefore, the cumulative impact would not increase above **minor adverse**.

21.8.2.2 Cumulative impact 3: ESSs

21.8.2.2.1 Norfolk Boreas

229. There are no ESSs at the Norfolk Vanguard onshore project substation therefore no impact is predicted cumulatively. Along the onshore cable route, land would be reinstated during operation, with the exception of link boxes, with a **negligible** impact predicted.

21.8.3 Cumulative Impacts during Decommissioning

230. Decommissioning of Norfolk Boreas and Hornsea Project Three may potentially take place at the same time as the Norfolk Vanguard project. The detail and scope of the decommissioning works for the Norfolk Vanguard project will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be the same as those identified during the construction stage.

21.9 Inter-relationships

231. Parameters or 'sources' that are considered to interact with receptors identified in this chapter are listed in Table 21.19.

Table 21.19 Inter-relationships with land use and agriculture

Inter-relationship and linked chapter	Section where addressed	Rationale
Chapter 19 Ground Conditions and Contamination	21.6, 21.7, 21.8	Changes in soil quality could impact on ground conditions and potential contaminated land.
Chapter 20 Water Resources and Flood Risk	21.7, 21.8	Potential impacts on drainage could lead to

Inter-relationship and linked chapter	Section where addressed	Rationale
		changes in flood risk or water resources e.g. private water supplies
Chapter 22 Onshore Ecology	21.6, 21.7, 21.8	Changes to land uses could impact on ecological receptors for example the removal of trees or hedgerows or the loss of agricultural land.
Chapter 24 Traffic and Transport	21.6, 21.7, 21.8	Changes in land uses e.g. at roads or paths could affect traffic and transport.
Chapter 28 Onshore Archaeology and Cultural Heritage	21.6, 21.7	Potential impacts on land use could affect any buried archaeology present.
Chapter 29 Landscape and Visual Impact Assessment	21.6, 21.7, 21.8	Changes to land uses could impact on the landscape and visual amenity.
Chapter 31 Socio-economics	21.6, 21.7, 21.8	Changes in the agricultural industry may affect the socio-economics of the region.

21.10 Interactions

232. The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. The worst case impacts assessed within the chapter take these interactions into account and for the impact assessments are considered conservative and robust. For clarity the areas of interaction between impacts are presented in Table 21.20, along with an indication as to whether the interaction may give rise to synergistic impacts.

Table 21.20 Interaction between impacts

Potential interaction between impacts Construction	1 Drainage	2 Land taken out of existing use	3 Degradation of natural resources - soil	4 Erosion of soil	5 ESS	6 Utilities
1 Drainage	-	Yes	Yes	Yes	No	No

Potential interaction between impacts						
Construction						
	1 Drainage	**2 Land taken out of existing use**	**3 Degradation of natural resources - soil**	**4 Erosion of soil**	**5 ESS**	**6 Utilities**
2 Land taken out of existing use	Yes	-	Yes	Yes	Yes	Yes
3 Degradation of natural resources - soil	Yes	Yes	-	Yes	Yes	No
4 Erosion of soil	Yes	Yes	Yes	-	Yes	No
5 ESS	No	Yes	Yes	Yes	-	No
6 Utilities	No	Yes	No	No	No	-
Operation						
	1 Drainage	**2 Permanent land use change**	**3 ESS**	**4 Utilities**		
1 Drainage	-	Yes	No	No		
2 Permanent land use change	Yes	-	Yes	No		
3 ESS	No	Yes	-	No		
4 Utilities	No	No	No	-		
Decommissioning						
It is anticipated that the decommissioning impacts will be similar in nature to those of construction.						

21.11 Summary

233. This section summarises the main findings from the impact assessment. This is outlined in Table 21.21.

234. The onshore project area crosses land in agricultural use. This land is predominantly of high to medium ALC grade (between ALC grades 2 and 3), with the onshore project substation located in ALC grade 3 land. About a quarter of the land in the onshore project area is on land subject to ESS. However no Higher Level Stewardship Schemes are recorded along the onshore cable route or at the landfall.

235. During construction land drains may be crossed; these receptors are considered to be highly sensitive. An ALO would be employed to undertake pre-construction land surveys to provide a baseline for reinstatement of drains following the works, as well as to assist with appropriate micro-siting of works. Due to the proposed embedded and some additional mitigation, no significant impacts are predicted on land take, ESS or drainage systems.

236. Several different soil types would be crossed by the onshore project area, with the sensitivity of soils considered to be high. A CoCP containing a SMP will be produced, incorporating a number of requirements to apply best practice techniques to all aspects of the project. These documents would ensure that the potential risks relating to land use and agriculture do not result in significant impacts during the project. Key aspects of the CoCP would include removal, storage and reinstatement of topsoil and subsoil layers; vehicle control to prevent soil damage by traffic movements; pollution control measures; fuel and materials storage and waste management. Following adherence to CoCP, no significant impacts are predicted to soils as a result of the project. An OCoCP (document reference 8.1) has been produced and submitted as part of the DCO application.

237. The landfall and onshore cable route cross a number of utilities related to domestic services for gas, electricity, water and sewerage connections. Norfolk Vanguard Limited will identify services on the ground prior to construction in consultation with utility providers, and undertake utility crossings or diversions in accordance with the appropriate standards for such crossings or works, avoiding any potential impacts to utilities.

238. A **minor adverse** impact was predicted at the local level for the construction and operation of the onshore project substation, since it would result in permanent land take. However, this is not considered to be significant at the county scale, as it accounts for a small percentage of agricultural resource in Norfolk.

239. Land would be directly taken out of existing use or isolated due to construction activities and effectively taken out of use, and soil erosion or degradation may lead to loss of productivity. Private agreements will be sought between Norfolk Vanguard Limited and relevant landowners/occupiers regarding any measures required in relation to crop loss incurred as a direct consequence of the construction phase of the project.

240. No impacts during operation were considered to result in more than a **minor adverse** impact.

241. Impacts on drainage have the potential to lead to a **minor adverse** impact when assessed cumulatively with Norfolk Boreas and Hornsea Three. In the case of

Norfolk Boreas, it is known that the project will seek to adopt similar mitigation strategies, and Hornsea Three would be likely to adopt similar mitigation strategies, seeking to avoid, reduce and offset the effects on drainage.

242. Impacts for decommissioning were predicted to be similar to construction in the absence of further information on the likely process of decommissioning at this time.

Table 21.21 Potential impacts identified for land use and agriculture

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
Construction						
1	Drainage	Medium	Low	Minor adverse	Yes – drainage contractor, Drainage Plan, CoCP, SMP	Negligible
2	Land taken out of existing use	Medium	Medium	Moderate adverse	Yes – SMP, private agreements	Minor adverse
3	Degradation of natural resources - soil	Low	Low	Minor adverse	Yes – SMP, private agreements	Negligible
4	Erosion of soil	Low	Medium	Minor adverse	Yes – private agreements	Negligible
5	ESS	Medium	Negligible	Minor adverse	Yes – private agreements	Negligible
6	Utilities	N/A.	N/A	No impact	N/A	No impact
Operation						
1	Drainage	N/A	N/A	No impact	N/A	No impact
2	Permanent land use change	Medium	Low	Minor adverse	Yes – private agreements	Negligible
3	ESS	N/A.	N/A	Negligible	N/A	Negligible
4	Utilities	N/A	N/A	No impact	N/A	No impact
Decommissioning						
It is anticipated that the decommissioning impacts will be no worse than those for construction.						
Cumulative - construction						
1	Drainage	Medium	Medium	Moderate adverse	Yes – drainage contractor, Drainage Plan	Minor adverse

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
2	Land taken out of existing use	As per construction				
3	Natural resources - soil	As per construction				
4	Loss of soil – erosion	As per construction				
5	ESS	As per construction				
6	Utilities	N/A				
Cumulative - operation						
1	Drainage	N/A				
2	Permanent change to land use	As per operation				
3	ESS	As per operation				
4	Utilities	N/A				
Cumulative - decommissioning						
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be the same as those identified during the construction stage.						

21.12 References

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