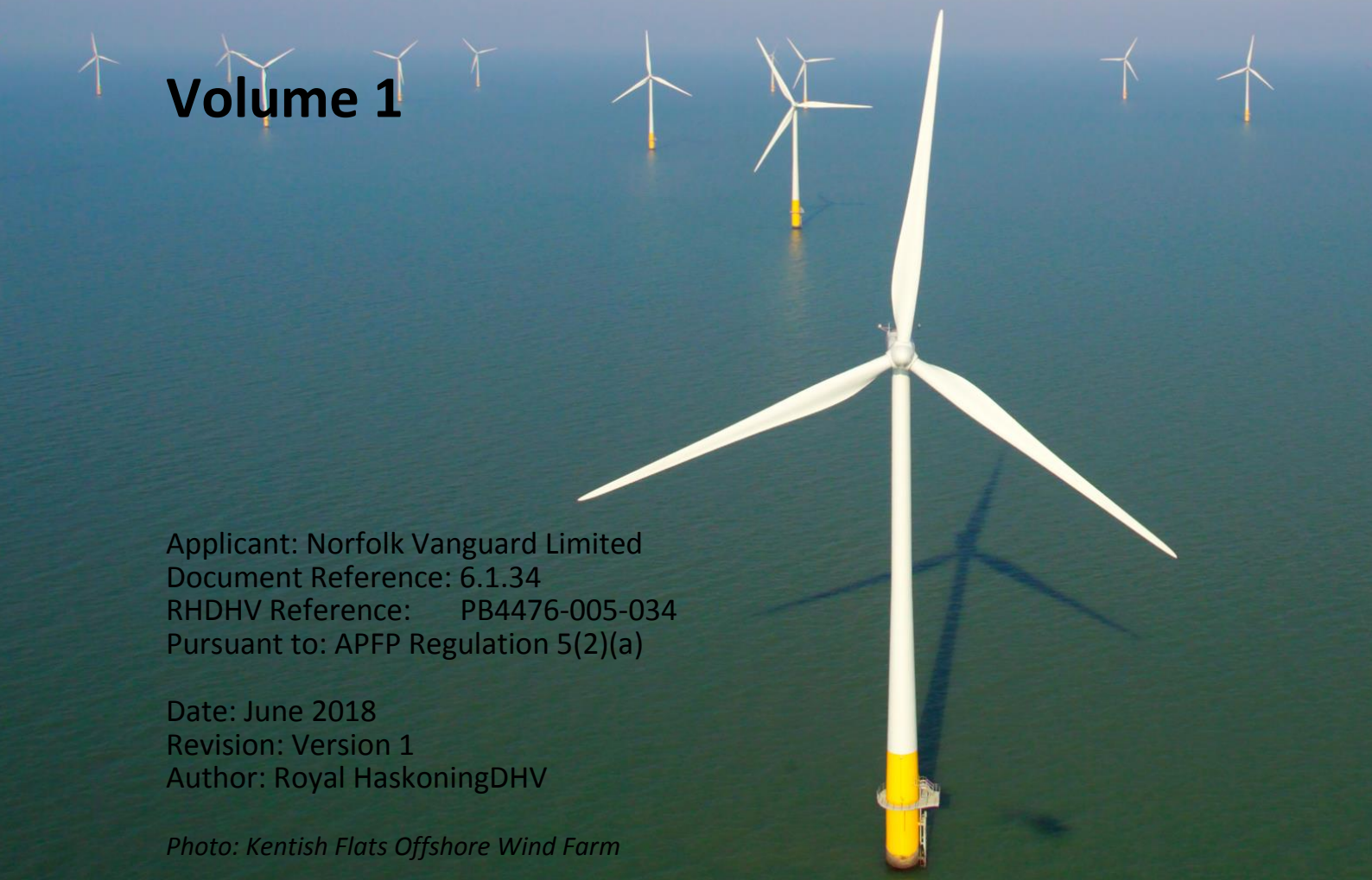
Norfolk Vanguard Offshore Wind Farm

Chapter 34

Summary

Environmental Statement

Volume 1



Applicant: Norfolk Vanguard Limited
Document Reference: 6.1.34
RHDHV Reference: PB4476-005-034
Pursuant to: APFP Regulation 5(2)(a)

Date: June 2018
Revision: Version 1
Author: Royal HaskoningDHV

Photo: Kentish Flats Offshore Wind Farm

Environmental Impact Assessment
Environmental Statement

Document Reference: PB4476-005-034

June 2018

For and on behalf of Norfolk Vanguard Limited

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Date: 10th June 2018

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Date: 10th June 2018

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
01/06/18	01D	First draft for Norfolk Vanguard Limited review	AG / KC	ST	AH
08/06/18	01F	Final draft for Norfolk Vanguard Limited review	GK	JA	JA
10/06/18	02F	Final for ES submission	GK	JA	JA

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Glossary

AEZ	Archaeological Exclusion Zone
CAA	Civil Aviation Authority
CoCP	Code of Construction Practice
CNMP	Construction Noise Management Plan
cSAC	Candidate Special Area of Conservation
DCO	Development Consent Order
EIA	Environmental Impact Assessment
EMF	Electromagnetic field
ES	Environmental Statement
FSA	Formal Safety Assessment
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
HVDC	High Voltage Direct Current
IAQM	Institute of Air Quality Management
LVIA	Landscape and Visual Impact Assessment
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MOD	Ministry of defence
NATs	National Air Traffic Service
NRA	Navigation Risk Assessment
OLEMS	Outline Landscape and Ecological Management Strategy
SAC	Special Area of Conservation
SNCB	Statutory Nature Conservation Bodies
SNS	Southern North Sea
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
TMP	Traffic Management Plan
UXO	Unexploded Ordnance

Terminology

Array cables	Cables which link the wind turbines and the offshore electrical platform.
Attenuation pond zone	Zone within which the attenuation pond at the onshore project substation or Necton National Grid substation will be located.
Export capacity	Maximum power transfer from the wind farm into the National Electricity Transmission System (NETS) (i.e. at the offshore transmission entry point)
Indicative mitigation planting	Areas identified for mitigation planting at the onshore project substation and Necton National Grid substation.
Interconnector cables	Buried offshore cables which link the offshore electrical platforms
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
Landfall compound	Compound at landfall within which HDD drilling would take place
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.
Mobilisation zone	Area within which the mobilisation area will be located.
National Grid new / replacement overhead line tower	New overhead line towers to be installed at the National Grid substation.
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
National Grid temporary works area	Land adjacent to the Necton National Grid substation which would be temporarily required during construction 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
Offshore accommodation platform	A fixed structure (if required) providing accommodation for offshore personnel. An accommodation vessel may be used instead
Offshore cable corridor	The corridor of seabed from the Norfolk Vanguard OWF sites to the landfall site within which the offshore export cables would be located.
Offshore electrical platform	A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which bring electricity from the offshore electrical platform to the landfall.
Offshore project area	The overall area of Norfolk Vanguard East, Norfolk Vanguard West and the offshore cable corridor
Onshore 400kV cable route	Buried high-voltage cables linking the onshore project substation to the Necton National Grid 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 cables	The cables which take the electricity from landfall to the onshore project substation
Onshore project area	All onshore electrical infrastructure (landfall; onshore cable route, accesses, trenchless crossing technique (e.g. Horizontal Directional Drilling (HDD)) zones and mobilisation areas; onshore project substation and extension to the Necton National Grid substation and overhead line modification)

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.
Onshore project substation temporary construction compound	Land adjacent to the onshore project substation which would be temporarily required during construction of the onshore project substation.
Running track	The track along the onshore cable route which the construction traffic would use to access workfronts
Safety zones	A marine zone outlined for the purposes of safety around a possibly hazardous installation or works / construction area under the Energy Act 2004.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.
The Applicant	Norfolk Vanguard Limited
The OWF sites	The two distinct offshore wind farm areas, Norfolk Vanguard East and Norfolk Vanguard West
The project	Norfolk Vanguard Offshore Wind Farm, including the onshore and offshore infrastructure
Trenchless crossing zone (e.g. HDD)	Temporary areas required for trenchless crossing works.

34 SUMMARY

34.1 Introduction

1. Norfolk Vanguard Limited ('the Applicant', an affiliate company of Vattenfall Wind Power Ltd (VWPL)) is seeking a Development Consent Order (DCO) for Norfolk Vanguard Offshore Wind Farm (OWF) (hereafter 'the project').

2. This chapter provides a summary of the potential impacts associated with the construction, operation and maintenance (O&M), and decommissioning of Norfolk Vanguard based on the assessments undertaken for each receptor, for both offshore and onshore topics as they are presented in the technical chapters of the Environmental Statement (ES) (Chapters 8 to 31). Cumulative and transboundary impacts are also detailed in each technical chapter, where applicable, and are summarised in Chapter 32 Offshore Cumulative and Transboundary Impacts and Chapter 33 Onshore Cumulative Impacts.

3. The ES covers a wide range of physical, ecological and human environmental receptors for which potential impacts have been assessed. The methodology for the Environmental Impact Assessment (EIA) is outlined in Chapter 6 EIA Methodology and detailed further in each technical chapter. Where an impact assessment methodology for a certain receptor deviates from the standard methodology outlined in Chapter 6, this is explained in the relevant chapter. The approach to EIA has largely been informed by consultation which has been undertaken with relevant technical consultees (see Chapter 7 Technical Consultation).

34.1.1 The Project

4. The OWF comprises two distinct areas, Norfolk Vanguard East (NV East) and Norfolk Vanguard West (NV West) ('the OWF sites') in the southern North Sea. The OWF sites would be connected to a landfall point at Happisburgh South, Norfolk, by offshore export cables installed within the offshore cable corridor. From there, onshore cables would transport power over approximately 60km to the onshore project substation at Necton, Norfolk.

5. Once built, Norfolk Vanguard would have an export capacity of up to 1800MW, with the offshore components comprising:

   - Wind turbines;
   - Offshore electrical platforms;
   - Accommodation platforms;
   - Met masts;
   - Measuring equipment (LiDAR and wave buoys);

- Array cables;
- Inter-connector cables; and
- Export cables.

6. The key onshore components of the project are as follows:

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

7. A full project description is given in the Chapter 5 Project Description and the worst case scenarios for each receptor are detailed in each technical chapter (Chapters 8 to 31).

34.1.1.1 Embedded mitigation

8. Norfolk Vanguard Limited has committed to a number of mitigation measures which are embedded in the project design and therefore incorporated in the impact assessments. A number of these commitments have been made as a result of public and/or stakeholder consultation (discussed further in the Consultation Report, document reference 5.1). Key commitments include the following and are discussed further in each technical chapter, where relevant:

- Offshore
  - Careful site selection to avoid designated sites and existing infrastructure where possible;
  - Reduction in the maximum number of turbines from 257 to 200;
  - Reduction in the number of offshore export cable trenches from six to two by committing to use High Voltage Direct Current (HVDC) technology;
  - Pre-construction survey prior to cable installation to inform micrositing, where possible, around important seabed features and obstacles;
  - Sort start and ramp up of piling activity;
  - Minimising cable protection by burying cables where possible;
  - Disposing of sediment arising within the Haisborough Hammond and Winterton Special Area of Conservation (SAC) during cable installation works, back into the SAC;
- Landfall
  - Long HDD will be used, avoiding any works on the beach/intertidal zone;
- Onshore

- Duct installation for Norfolk Vanguard and its sister project Norfolk Boreas will be undertaken in parallel (subject to both projects being consented) in order to minimise ongoing disruption;
- Careful site selection to avoid designated sites and ancient woodlands;
- Removal of the requirement for a cable relay station due to the commitment to use HVDC technology;
- Reduction in the cable easement width from 100m to 45m due to the commitment to use HVDC technology;
- Trenchless crossings will be undertaken at major watercourses, County Wildlife Sites (CWS) and other key sensitive features;
- Mitigation planting will be undertaken to screen visual impacts of the project where possible; and
- Reduction in hedgerow crossing gaps from 54m to 20m (or 25m where a crossing at an angle is required) due to the commitment to use HVDC technology.

9. Where appropriate, further topic specific embedded mitigation and additional mitigation measures would be adopted and these are detailed in each technical chapter.

34.2 Offshore

34.2.1 Chapter 8 Marine Geology, Oceanography and Physical Processes

10. The assessment for marine geology, oceanography and physical processes has been informed by a number of geophysical surveys of the project and wider area, and related modelling.

11. The assessment considers impacts on Marine Geology, Oceanography and Physical Processes receptors which include:

- Haisborough, Hammond and Winterton SAC;
- North Norfolk Sandbanks and Saturn Reef SAC;
- Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ).; and
- East Anglian coast.

12. Due to the distance from the OWF sites to these receptors, the EIA has concluded **no impact** in relation to works in the OWF sites.

13. The offshore cable corridor passes through the Haisborough Hammond and Winterton SAC, approximately 2km to the south of North Norfolk Sandbanks and Saturn Reefs SAC, approximately 60m to the south of the MCZ and makes landfall at Happisburgh South on the East Anglian coast. The impacts associated with these works have been assessed as having, at most, **negligible** significance on these

receptors (Table 34.1). Effects on the Haisborough Hammond and Winterton SAC are considered further in the Information to Support HRA Report (document reference 5.3).

14. Chapter 8 also identifies potential effects/changes on marine physical processes for which the receptor is considered in other Chapters (e.g. Chapter 9 Marine Water and Sediment Quality and Chapter 10 Benthic and Intertidal Ecology).

Table 34.1 Potential impacts identified for marine geology, oceanography and physical processes

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Changes in Suspended Sediment Concentrations due to Seabed Preparation for Wind Turbine Gravity Anchor Foundation Installation	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Changes in Suspended Sediment Concentrations due to Drill Arisings for Installation of Piled Foundations for Wind Turbines	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Impact 2A: Changes in Seabed Level due to Seabed Preparation for Wind Turbine Gravity Anchor Foundation	Haisborough, Hammond and Winterton SAC	Negligible	Negligible (far-field)	**Negligible**	None proposed	**Negligible**
	North Norfolk	Negligible	Negligible (far-field)	**Negligible**	None proposed	**Negligible**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Installation	Sandbanks and Saturn Reef SAC					
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Impact 2B: Changes in Seabed Level due to Drill Arisings for Installation of Piled Foundations for Wind Turbines	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Impact 3: Changes in Suspended Sediment Concentrations during Offshore Export Cable Installation	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Changes in seabed level due to disposal of sediment from sand wave levelling in the offshore cable corridor	Haisborough, Hammond and Winterton SAC	Negligible	Low (near-field), Negligible (far-field)	**Negligible**	Embedded mitigation: Disposal in SAC	**Negligible**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Interruptions to Bedload Sediment Transport due to Sand Wave Levelling	Haisborough, Hammond and Winterton SAC	Negligible	Low (near-field), negligible (far-field)	**Negligible**	Embedded mitigation: Disposal in SAC	**Negligible**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Changes in Seabed Level due to Offshore Export Cable Installation	Haisborough, Hammond and Winterton SAC	Negligible	Low (near-field), negligible (far-field)	**Negligible**	Embedded mitigation: Disposal in SAC	**Negligible**
	North Norfolk Sandbanks and Saturn	N/A	N/A	**No impact**	N/A	**No impact**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	Reef SAC					
	Cromer Shoal Chalk Beds MCZ	Negligible	Low (near-field), negligible (far-field)	**Negligible**	None proposed	**Negligible**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Changes in Suspended Sediment Concentrations during cable installation in the OWF sites	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Changes in Seabed Level due to Cable Installation in the OWF sites	Haisborough, Hammond and Winterton SAC	Negligible	Negligible (far-field)	**Negligible**	None proposed	**Negligible**
	North Norfolk Sandbanks and Saturn Reef SAC	Negligible	Negligible (far-field)	**Negligible**	None proposed	**Negligible**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Indentations on the Seabed due to Installation Vessels	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Operation						
Changes to the Tidal Regime due to the Presence of Wind Turbine Structures	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	Negligible	Low (near-field), negligible (far-field)	**Negligible (southern part of cSAC/SCI)**	None proposed	**Negligible**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Changes to the Wave Regime due to the Presence of Wind Turbine Structures	Haisborough, Hammond and Winterton SAC	Negligible	Low (near-field), negligible (far-field)	**Negligible (south-east extreme of cSAC/SCI)**	None proposed	**Negligible**
	North Norfolk Sandbanks and Saturn	Negligible	Low (near-field), negligible (far-field)	**Negligible (south-east extreme of cSAC/SCI)**	None proposed	**Negligible**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	Reef SAC					
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Changes to the Sediment Transport Regime due to the Presence of Wind Turbine Foundation Structures	Haisborough, Hammond and Winterton SAC	Negligible	Low (near-field), negligible (far-field)	**Negligible (south-east extreme of cSAC/SCI)**	None proposed	**Negligible**
	North Norfolk Sandbanks and Saturn Reef SAC	Negligible	Low (near-field), negligible (far-field)	**Negligible (south and south-east extreme of cSAC/SCI)**	None proposed	**Negligible**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Loss of Seabed Morphology due to the Footprint of Wind Turbine Foundation Structures	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Morphological and Sediment Transport Effects due to Cable Protection Measures for Array and Interconnector Cables	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Morphological and Sediment Transport Effects due to Cable Protection Measures for Offshore Cables	Haisborough, Hammond and Winterton SAC	N/A	N/A	**No impact**	N/A	**No impact**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Cable repairs/reburial and maintenance vessel footprints	Haisborough, Hammond and Winterton SAC	Negligible	Low (near-field), negligible (far-field)	**Negligible**	None proposed	**Negligible**
	North Norfolk Sandbanks and Saturn Reef SAC	N/A	N/A	**No impact**	N/A	**No impact**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	Cromer Shoal Chalk Beds MCZ	N/A	N/A	**No impact**	N/A	**No impact**
	East Anglian coast	N/A	N/A	**No impact**	N/A	**No impact**
Decommissioning						
As for construction						

34.2.2 Chapter 9 Marine Water and Sediment Quality

15. The assessment for Marine Water and Sediment Quality has been informed by contaminants analysis of seabed sediment samples collected during a site characterisation survey in 2016, as well as considering available regional information and data collected for the former East Anglia Zone.

16. The effects associated with marine physical processes identified in Chapter 8 also inform the impact assessment for Marine Water and Sediment Quality. The assessment considers impacts on the Norfolk East coastal water body, protected by the Water Framework Directive (WFD), and bathing waters.

17. The impact assessment and embedded mitigation has taken into account the requirements of key European and national legislation and policy concerning environmental quality standards for chemical contaminants and guideline values to determine sediment quality. Through the commitment to embedded mitigation, including the implementation of a Project Environmental Management Plan (as required under condition 14(1)(d) of the Deemed Marine Licences (DMLs), impacts have been assessed as **negligible** or **minor adverse** significance.

18. Changes to water quality have the potential to affect ecological receptors and are therefore considered further in the relevant chapters (e.g. Chapter 10 Benthic and Intertidal Ecology, Chapter 11 Fish and Shellfish Ecology, and Chapter 12 Marine Mammals).

Table 34.2 Potential Impacts Identified for marine sediment and water quality

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Deterioration in water quality due to increased suspended sediment concentrations during installation of foundations	Water Quality	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Deterioration in water quality due to increased suspended sediment concentrations due to drill arisings for installation of piled foundations	Water Quality	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Deterioration in water quality due to increased suspended sediment concentrations during installation of the offshore export cable	Water Quality	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Deterioration in water due to increased suspended sediment concentrations during array and interconnector cable installation	Water Quality	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Deterioration in water and bathing water quality due to works at the offshore export cable landfall	Water Quality	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Deterioration in water quality	Water Quality	Low	Negligible	**Negligible**	None proposed	**Negligible**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
due to re-suspension of sediment bound contaminants						
Operation						
There are no operational effects anticipated on marine sediment and water quality as embedded mitigation will remove the risk of any effects occurring						
Decommissioning						
Deterioration in water quality due to increased suspended sediment concentrations during foundation removal of accessible installed components	As for construction					

34.2.3 Chapter 10 Benthic and Intertidal Ecology

19. A broad scale survey of the seabed ecology of the former East Anglia Zone (within which the OWF sites are located) was conducted in 2010 and 2011. In addition, a site specific survey was undertaken in the Norfolk Vanguard project area in 2016. These studies included a combination of samples taken from the seabed using a grabbing device, trawling gear and underwater video imagery.

20. The effects associated with marine physical processes as identified in Chapter 8 and marine water and sediment quality in Chapter 9 also inform the impact assessment for Benthic Ecology, and the approach closely follows the standard methodology outlined in Chapter 6.

21. The impacts on benthic ecology associated with construction, O&M and decommissioning are anticipated to result in changes of **minor adverse** or **negligible** significance.

22. Due to the commitment to use long HDD at the landfall, there would be no works in the intertidal zone and therefore **no impact** on intertidal ecology.

23. Effects on the Haisborough Hammond and Winterton SAC are considered further in the Information to Support Habitats Regulations Assessment Report (document reference 5.3).

Table 34.3 Potential impacts identified for benthic and intertidal ecology

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Temporary habitat loss / disturbance	Habitats and species within NV West and NV East	Low to Medium	Low	**Minor Adverse**	Embedded mitigation only	**Minor Adverse**
	Habitats and species within Offshore cable corridor	Low to Medium	Low	**Minor Adverse**	Embedded mitigation only	**Minor Adverse**
	The Haisborough, Hammond and Winterton SAC	Medium	Low	**Minor Adverse**	Embedded mitigation only	**Minor Adverse**
	Intertidal benthic ecology	No receptors present	N/A	**No impact**	N/A	**No impact**
Temporary increase in suspended sediment concentrations and associated sediment deposition.	Habitats and species within NV West and NV East	Medium	low	**Minor Adverse**	Embedded mitigation only	**Minor Adverse**
	Habitats and species within Offshore cable corridor	Medium	Low	**Minor Adverse**	Embedded mitigation only	**Minor Adverse**
	Haisborough, Hammond and Winterton SAC	Medium	Low	**Minor Adverse**	Embedded mitigation only	**Minor Adverse**
	Cromer Shoal Chalk Beds MCZ	Low	Negligible	**Negligible**	Embedded mitigation only	**Negligible**
Changes to water quality due to re-mobilisation of contaminated sediments	Habitats and species within the offshore project area	N/A	N/A	**No impact**	N/A	**No impact**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Underwater noise and vibration	Habitats and species within NV West and NV East	Medium	Low	**Minor adverse**	Embedded mitigation only	**Minor Adverse**
Operation						
Permanent loss of seabed habitat through the presence of seabed infrastructure	Habitats and species within NV West	Medium	Low	**Minor Adverse**	Embedded mitigation only	**Minor Adverse**
	Habitats and species within NV East	Medium	Low	**Minor adverse**	Embedded mitigation only	**Minor Adverse**
	Habitats and species within the offshore cable corridor	Low or medium	Negligible	**Negligible**	Embedded mitigation only	**Negligible**
	Haisborough, Hammond and Winterton SAC	Medium	Low	**Minor adverse**	Embedded mitigation only	**Minor adverse**
Temporary seabed disturbances from maintenance operations	Habitats and species within NV West	Medium	Low	**Minor adverse**	Embedded mitigation only	**Minor adverse**
	Habitats and species within NV East	Low	Low	**Minor adverse**	Embedded mitigation only	**Minor adverse**
	Habitats and species within the offshore cable corridor	Medium	Negligible	**Minor adverse**	Embedded mitigation only	**Minor adverse**
Increases in suspended sediment concentrations and associated sediment deposition	Habitats and species within the offshore project area	Low	Low to negligible	**Minor adverse**	Embedded mitigation only	**Minor adverse**
Colonisation of turbines/cable	Habitats and species within the offshore	Medium	Low	**Minor adverse**	Embedded mitigation only	**Minor adverse**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
protection/scour protection	project area					
Electromagnetic Fields (EMF) from installed array and export cables	Benthic fauna	Negligible	Negligible	**Negligible**	Embedded mitigation only	**Negligible**
Decommissioning						
As for construction						

34.2.4 Chapter 11 Fish and Shellfish Ecology

24. Various existing data sources, including surveys of the former East Anglia Zone have been used to characterise the species of fish and shellfish that could be impacted by Norfolk Vanguard. It was agreed during consultation with Natural England and the Marine Management Organisation (MMO), that no further site specific surveys were required for fish due to the ability to characterise the site appropriately using existing data.

25. The effects on fish and shellfish ecology associated with construction, O&M and decommissioning are anticipated to impacts of **negligible** or **minor adverse** significance to all receptors.

Table 34.4 Potential impacts identified for Fish and Shellfish receptors

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Physical disturbance and temporary loss of seabed habitat	Fish in general	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Sandeels	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Herring	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Thornback ray	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Shellfish	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
Increased suspended sediment concentrations and sediment re-deposition	Adult and juvenile fish in general	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Sandeels	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Herring	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Other species with spawning grounds in the offshore project area	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Shellfish	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Underwater noise from piling (mortality/recoverable injury)	Fish with no swim bladder	Low - general	Negligible	**Negligible**	None proposed	**Negligible**
		Medium -sandeels	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Fish with swim bladder not involved in hearing	Low -general	Negligible	**Negligible**	None proposed	**Negligible**
		Medium- Gobies	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Fish with swim bladder involved in	Low	Negligible	**Negligible**	None proposed	**Negligible**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	hearing					
	Eggs and larvae	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Shellfish	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
Underwater noise from piling (temporary threshold shift (TTS) and behavioural)	Sole, plaice, lemon sole and mackerel	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Sandeels	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Sea bass	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Cod, whiting and sprat	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Herring	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Elasmobranches	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Diadromous species	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Indirect impacts on fish species as a result of behavioural disturbance to prey species associated with construction noise	Piscivorous fish	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Underwater noise from other construction activities	Fish and shellfish in general	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Noise from Unexploded Ordnance (UXO) clearance	Fish and shellfish in general	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
Operation						
Permanent loss of seabed	Fish and shellfish in	Low	Low	**Minor adverse**	None proposed	**Minor adverse**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
habitat	general					
	Sandeels	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Herring	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Introduction of hard substrate	Fish and shellfish in general	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Underwater noise during operation	Fish and shellfish in general	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
EMFs	Elasmobranchs	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Lamprey	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Salmon and sea trout	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	European eel	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Other fish species	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Shellfish	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Decommissioning						
Physical disturbance and temporary loss of habitat	**As above for the construction phase**					
Increased SSCs and sediment re-deposition	**As above for the construction phase**					
Underwater noise from foundation removal	**As above for the construction phase**					
Underwater noise from other decommissioning activities	**As above for the construction phase**					

34.2.5 Chapter 12 Marine Mammal Ecology

26. Marine mammals were recorded during high resolution aerial surveys conducted over 32 months for NV East and 24 months for NV West (including a 4km buffer around each site) as part of the offshore ornithology surveys (section 34.2.6). The site specific surveys recorded low numbers of marine mammals, such that only three species occurred in numbers sufficient to justify assessment. The species assessed were harbour porpoise, harbour seal and grey seal.

27. Effects on marine mammal ecology associated with construction, O&M and decommissioning are anticipated to result in impacts of **negligible** to **minor adverse** significance following the implementation of embedded mitigation, such as piling soft-start and ramp up, as well as additional mitigation that would be implemented through a Marine Mammal Mitigation Protocol (MMMP) and a Norfolk Vanguard Southern North Sea (SNS) cSAC Site Integrity Plan (SIP). The MMMP and SIP would be developed in consultation with relevant Statutory Nature Conservation Bodies (SNCBs) and the MMO prior to construction in accordance with the draft MMMP for Piling (document reference 8.13) and In Principle SIP (document reference 8.17) submitted with the DCO application.

28. Effects on the SNS candidate Special Area of Conservation (cSAC) are considered further in the Information to Support Habitats Regulations Assessment Report (document reference 5.3).

Table 34.5 Summary of potential impacts for marine mammals

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Impact 1: Underwater UXO Clearance						
- Permanent auditory injury	Harbour porpoise	High	Medium	**Major adverse**	MMMP for UXO clearance.	**Minor adverse**
	Grey seal & harbour seal	High	Low to Negligible	**Moderate to Minor adverse**		**Minor adverse**
- TTS and fleeing response	Harbour porpoise, grey seal & harbour seal	Medium	Negligible	**Minor adverse**	MMMP for UXO clearance.	**Minor adverse**
- Disturbance	Harbour porpoise	Medium	Negligible	**Minor adverse**	SIP for SNS cSAC	**Minor adverse**
	Grey seal	Medium	Low	**Minor adverse**		**Minor adverse**
	Harbour seal	Medium	Negligible	**Minor adverse**		**Minor adverse**
Impact 2: Underwater Noise during Piling						
- PTS from single strike of starting hammer energy	Harbour porpoise	High	Negligible	**Minor adverse**	MMMP for piling	**Minor adverse**
	Grey seal & harbour seal	High	Negligible	**Minor adverse**		**Minor adverse**
- PTS from single strike of maximum hammer energy	Harbour porpoise	High	Negligible	**Minor adverse**	MMMP for piling including embedded mitigation	**Minor adverse**
	Grey seal & harbour seal	High	Negligible	**Minor adverse**		**Minor adverse**
- PTS from Cumulative SEL	Harbour porpoise	High	Negligible to Low	**Minor to Moderate adverse**	MMMP for piling including embedded mitigation	**Minor adverse**
	Grey seal & harbour seal	High	Negligible	**Minor adverse**		**Minor adverse**
- TTS and fleeing response	Harbour porpoise	Medium	Negligible	**Minor adverse**	MMMP for piling	**Minor adverse**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	Grey seal & harbour seal	Medium	Negligible	**Minor adverse**	including embedded mitigation	**Minor adverse**
- Disturbance during piling for single installation	Harbour porpoise	Medium	Negligible	**Minor adverse**	SIP for SNS cSAC	**Minor adverse**
	Grey seal & harbour seal	Medium	Negligible	**Minor adverse**		**Minor adverse**
- Disturbance during concurrent piling	Harbour porpoise	Medium	Negligible to Low	**Minor adverse**		**Minor adverse**
	Grey seal & harbour seal	Medium	Negligible	**Minor adverse**		**Minor adverse**
- Possible behavioural	Harbour porpoise	Low	Low	**Minor adverse**		**Minor adverse**
Impact 3: Underwater Noise during Other Construction Activities						
- Disturbance	Harbour porpoise, grey seal & harbour seal	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
Impact 4: Vessel Underwater Noise and Disturbance						
- Disturbance	Harbour porpoise	Low	Negligible	**Negligible**	None proposed	**Negligible**
	Grey seal & harbour seal	Low	Negligible	**Negligible**		**Negligible**
Impact 5: Barrier Effects from Underwater Noise						
- Disturbance	Harbour porpoise	Medium	Low	**Minor adverse**	SIP	**Minor**
	Grey seal	Medium	Negligible	**Minor adverse**		**Minor**
	harbour seal	Medium	Negligible	**Minor adverse**		**Minor**
Impact 6: Vessel Collision Risk						
- Increased collision risk	Harbour porpoise	Low	Medium	**Minor adverse**	None proposed	**Minor**
	Grey seal & harbour	Low	Low	**Minor adverse**		**Minor**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	seal					
Impact 7: Disturbance at Seal Haul-Out Sites						
- Disturbance	Grey seal & harbour seal	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 8: Changes to Prey Resource						
- Disturbance	Harbour porpoise	Low to Medium	Negligible	**Negligible to Minor**	None proposed	**Negligible to Minor**
	Grey seal	Low	Negligible	**Negligible**		**Negligible**
Impact 9: Changes to Water Quality						
- Increased suspended sediment	Harbour porpoise	Negligible	Negligible	**Negligible**	None proposed	**Negligible**
	Grey seal & harbour seal	Negligible	Negligible	**Negligible**		**Negligible**
Operation						
Impact 1: Underwater Noise from Operational Turbines						
- Disturbance	Harbour porpoise	Low	Low	**Minor**	None proposed	**Minor**
	Grey seal	Low	Negligible	**Negligible**		**Negligible**
	Harbour seal	Low	Negligible	**Negligible**		**Negligible**
Impact 2: Underwater Noise from Maintenance Activities						
- Disturbance	Harbour porpoise	Medium	Negligible	**Minor**	None proposed	**Minor**
	Grey seal & harbour seal	Medium	Negligible	**Minor**		**Minor**
Impact 3: Vessel Underwater Noise and Disturbance during Operation and Maintenance						
- Disturbance	Harbour porpoise	Low	Negligible	**Negligible**	None proposed	**Negligible**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	Grey seal & harbour seal	Low	Negligible	**Negligible**		**Negligible**
Impact 4: Vessel Collision Risk						
- Increased collision risk	Harbour porpoise	Low	Medium	**Minor**	None proposed	**Minor**
	Grey seal & harbour seal	Low	Low	**Minor**		**Minor**
Impact 5: Disturbance at Seal Haul-Out Sites						
- Disturbance	Grey seal & harbour seal	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 6: Entanglement in Floating Foundations						
- Entanglement	Harbour porpoise	Negligible	Low	**Negligible**	None proposed	**Negligible**
	Grey seal & harbour seal	Negligible	Low	**Negligible**		**Negligible**
Impact 7: Changes to Prey Resource during Operation and Maintenance						
- Disturbance	Harbour porpoise	Low to Medium	Negligible	**Negligible to Minor**	None proposed	**Negligible to Minor**
	Grey seal	Low	Negligible	**Negligible**		**Negligible**
Decommissioning						
Impact 1: Underwater Noise						
- Disturbance	Harbour porpoise, grey seal & harbour seal	Medium	Low	**Minor**	None proposed	**Minor**
Impact 2: Barrier Effects from Underwater Noise						
- Disturbance	Harbour porpoise,	Medium	Low	**Minor**	None proposed	**Minor**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	grey seal & harbour seal					
Impact 3: Vessel Underwater Noise and Disturbance						
- Disturbance	Harbour porpoise	Low	Low	**Minor**	None proposed	**Minor**
	Grey seal & harbour seal	Low	Negligible	**Negligible**		**Negligible**
Impact 4: Vessel Collision Risk						
- Increased collision risk	Harbour porpoise	Low	Medium	**Minor**	None proposed	**Minor**
	Grey seal & harbour seal	Low	Negligible	**Negligible**		**Negligible**
Impact 5: Disturbance at Seal Haul-Out Sites						
- Disturbance	Grey seal & harbour seal	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 6: Changes to Prey Resource						
- Disturbance	Harbour porpoise	Low to Medium	Negligible	**Negligible to Minor**	None proposed	**Negligible to Minor**
	Grey seal	Low	Negligible	**Negligible**		**Negligible**
Impact 7: Changes to Water Quality						
- Increased suspended sediment	Harbour porpoise, grey seal & harbour seal	Negligible	Negligible	**Negligible**	None proposed	**Negligible**

34.2.6 Chapter 13 Offshore Ornithology

29. Use of the Norfolk Vanguard OWF sites by seabirds was characterised using high resolution aerial surveys conducted over 32 months for NV East and 24 months for NV West (including a 4km buffer around each site). The results of these surveys have been used to estimate the abundance and assemblage of birds using or passing across the area.

30. Effects on offshore ornithology associated with construction, O&M and decommissioning are anticipated to result in impacts of **negligible** to **minor adverse** significance.

Table 34.6 Potential impacts identified for offshore ornithology

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Disturbance and displacement from increased vessel traffic during export cable installation	Common scoter	High	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Red-throated diver	High	Negligible	**Minor adverse**	None proposed	**Minor adverse**
Disturbance and displacement due to construction activity on wind farm site	Red-throated diver	High	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Puffin	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
	Razorbill	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Guillemot	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
Indirect effects due to prey species displacement	All species	Low to high	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
Operation						
Disturbance and displacement	Red-throated diver	High	Negligible	**Minor**	None proposed	**Minor adverse**
	Gannet	Low to medium	Negligible	**Negligible to minor**	None proposed	**Negligible to minor**
	Puffin	Low to medium	Negligible to minor	**Minor**	None proposed	**Negligible to minor adverse**
	Razorbill	Medium	Negligible	**Minor**	None proposed	**Minor adverse**
	Guillemot	Medium	Negligible	**Minor**	None proposed	**Minor adverse**
Indirect effects due to impacts on habitats and prey species displacement	All species	Low to high	Negligible	**Negligible to minor**	None proposed	**Negligible to minor**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Collision Risk - seabirds	Gannet	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
	Kittiwake	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
	Lesser black-backed gull	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
	Great black-backed gull	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
Collision risk – migrant seabirds	Arctic skua	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
	Great skua	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
	Arctic tern	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
	Common tern	Low to medium	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
Collision risk – non-seabird migrants	All species	Low to high	Negligible	**Negligible**	None proposed	**Negligible**
Barrier effects	All species	Low to high	Negligible	**Negligible**	None proposed	**Negligible**
Decommissioning						
Direct disturbance and displacement	All species	Low to high	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**
Indirect impacts through effects on habitats and prey	All species	Low to high	Negligible	**Negligible to minor adverse**	None proposed	**Negligible to minor adverse**

34.2.7 Chapter 14 Commercial Fisheries

31. Various datasets were used to characterise the baseline and assess the potential impacts of Norfolk Vanguard on commercial fisheries receptors, including United Kingdom (UK) MMO fisheries statistics, surveillance sightings satellite tracking data and landings data from various EU countries (including the Netherlands, Belgium, Denmark, and France).

32. Fisheries activities of relevance to Norfolk Vanguard include Dutch vessels undertaking trawling (including UK flagged but Dutch owned beam trawlers) and seine netting and local UK static gear fisheries.

33. The key species for the trawlers include plaice and Dover sole, whilst the local fishermen target lobster, edible crab and whelks.

34. Effects on commercial fisheries associated with construction, O&M and decommissioning are anticipated to result in impacts of **negligible** to **minor adverse** significance.

35. Effects on safety on commercial fisheries are considered based on the outcomes of the Shipping and Navigation Assessment (explained further in section 34.2.8 and Chapter 15). These have been assessed as '**within acceptable limits'**.

Table 34.7 Potential impacts identified for commercial fisheries

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Impact 1: Adverse effects on commercially exploited Fish and Shellfish Populations	All commercial fisheries fleet	See Chapter 11: Fish and Shellfish Ecology		**Minor adverse**	None proposed	**Minor adverse**
Impact 2: Temporary Loss or Restricted Access to Traditional Fishing Grounds	Dutch Beam Trawling	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Dutch Seine Netting	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Dutch demersal otter and mid water trawling	Low	Negligible	**Negligible**	None proposed	**Negligible**
	Dutch nets, purse seines, traps and dredges	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Belgian Beam Trawling	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Belgian Demersal Otter Trawling	Low	Negligible	**Negligible**	None proposed	**Negligible**
	Belgian Seine Netting	Low	Negligible	**Negligible**	None proposed	**Negligible**
	UK Beam Trawling (Anglo-Dutch)	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	UK Beam Trawling (South-west ports)	Low	Negligible	**Negligible**	None proposed	**Negligible**
	UK Demersal Otter Trawling	Low	Negligible	**Negligible**	None proposed	**Negligible**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	UK inshore local static gear vessels	Medium	Low	**Minor adverse**	Implementation of evidence based mitigation in line with Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW) guidelines, where appropriate	**Minor adverse**
	French demersal and pelagic trawlers	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Danish industrial sandeel trawls and midwater trawls	Low	Negligible	**Negligible**	None proposed	**Negligible**
	German fishing vessels	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 3: Safety Issues for Fishing vessels	All commercial fishing vessels	N/A	N/A	**Within acceptable limits**	None proposed	**Within acceptable limits**
Impact 4: Increased Steaming Times to Fishing Grounds	All commercial fishing vessels	Negligible	Negligible	**Negligible**	None proposed	**Negligible**
Impact 5: Obstacles on the seabed post construction	All commercial fishing vessels	N/A	N/A	**Within acceptable limits**	None proposed	**Within acceptable limits**
Impact 6: Interference with	Static gear	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Fishing Activities	Mobile Gear	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 7: Displacement of Fishing Activity into other areas	Static Gear	Medium	Negligible	**Negligible**	None proposed	**Negligible**
	All towed gear methods	Low to Medium	Negligible to Low	**Negligible to Minor adverse**	None proposed	**Negligible to Minor adverse**
Operation						
Impact 1: Adverse impacts on Commercially Exploited Fish and Shellfish populations	All commercial fishing vessels	See Chapter 11: Fish and Shellfish Ecology		**Minor adverse**	None proposed	**Minor adverse**
Impact 2: Complete Loss or Restricted access to Traditional Fishing Grounds	Dutch Beam Trawling	Low	Medium	**Minor adverse**	None proposed	**Minor adverse**
	Dutch Sein Netting	Low	Medium	**Minor adverse**	None proposed	**Minor adverse**
	Dutch demersal otter and mid water trawling	Low	Negligible	**Negligible**	None proposed	**Negligible**
	Dutch nets, purse seines, traps and dredges	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Belgian Beam Trawling	Low	Negligible	**Negligible**	None proposed	**Negligible**
	Belgian Demersal Otter Trawling	Low	Negligible	**Negligible**	None proposed	**Negligible**
	Belgian Seine Netting	Low	Negligible	**Negligible**	None proposed	**Negligible**
	UK Beam Trawling (Anglo-Dutch)	Low	Medium	**Minor adverse**	None proposed	**Minor adverse**
	UK Beam Trawling (South-west ports)	Low	Negligible	**Negligible**	None proposed	**Negligible**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	UK Demersal Otter Trawling	Low	Negligible	**Negligible**	None proposed	**Negligible**
	UK Local Static Gears	Medium	Negligible	**Negligible**	None proposed	**Minor adverse**
	French demersal and pelagic trawls	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
	Danish sandeel industrial trawlers and midwater trawlers	Low	Negligible	**Negligible**	None proposed	**Negligible**
	German fishing vessels	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 3: Safety Issues for Fishing Vessels	All commercial fishing vessels	N/A	N/A	**Within acceptable limits**	None proposed	**Within acceptable limits**
Impact 4: Increased Steaming Times to Fishing Grounds	All commercial fishing vessels	Negligible	Negligible	**Negligible**	None proposed	**Negligible**
Impact 5: Obstacles on the seabed	All commercial fishing vessels	N/A	N/A	**Within acceptable limits**	None proposed	**Within acceptable limits**
Impact 6: Interference with Fishing Activities	Static Gear fleets	Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	Mobile gear fleets	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 7: Displacement of Fishing Activity into Other Areas	Static gear vessels	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Towed gear vessels	Low to Medium	Negligible to Medium	**Negligible to Minor adverse**	None proposed	**Negligible to Minor adverse**
Decommissioning						

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Impact 1 - **Impact 7** These impacts are assumed to be the same as during the construction phase	**The sensitivity of the receptors is considered to be the same to that identified for the construction phase. The magnitude of effect is considered to be no greater, and in all probability less, than in the construction phase. Therefore, it is anticipated that any decommissioning impacts would be no greater, and probably less than that assessed for the construction phase.**					
Impact 4: Increased Steaming Times to Fishing Grounds	All fishing fleets	Negligible	Low	**Negligible**	None proposed	**Negligible**
Impact 5: Obstacles on the seabed	**It is assumed that the same obligations in respect of seabed obstacles will apply to other projects/activities**					
Impact 6: Interference with Fishing Activities	Local static gear vessels	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Towed gear vessels	Low	Low	**Minor adverse**	None proposed	**Minor adverse**
Impact 7: Displacement of Fishing Activity into Other Areas	Local static gear vessels	Medium	Low	**Minor adverse**	None proposed	**Minor adverse**
	Towed gear vessels	Low to Medium	Negligible to Medium	**Negligible to Minor adverse**	None proposed	**Negligible to Minor adverse**

34.2.8 Chapter 15 Shipping and Navigation

36. Summer and winter shipping surveys were undertaken in 2016/17 to inform the impact assessment. A Navigation Risk Assessment (NRA) (Appendix 15.1) has been undertaken for the project and this informs the EIA. The NRA includes the required Formal Safety Assessment to meet Maritime and Coastguard Agency guidance for all phases of the project, as well as an assessment of cumulative effects.

37. Shipping and navigation impacts have been assessed using the International Maritime Organization Formal Safety Assessment (FSA) (IMO, 2002) process, as required by the MCA. The approach is broadly similar to that used for the wider EIA (see Chapter 6 EIA Methodology), however impact significance is categorised under the FSA approach as “no impact/no perceptible effect”; “broadly acceptable”; “tolerable (with or without mitigation)” or “unacceptable”. Further information on the methodology for assessing shipping and navigation impacts is provided in section 15.4.1 of Chapter 15.

38. Through the implementation of embedded mitigation, such as shipping safety zones during construction as well as lighting and marking of offshore infrastructure to comply with appropriate standards and as agreed with Trinity House and the Maritime Coastguard Agency, the impacts of Norfolk Vanguard are deemed to range from **no perceptible effect** to **tolerable with mitigation**.

Table 34.8 Potential impacts identified for shipping and navigation

Potential Impact	Receptor	Severity of Consequence	Frequency	Significance	Additional Mitigation	Residual Impact
Construction						
Effects on vessel routeing and / or displacement – OWF sites including interconnector and array cables	Commercial vessels	Minor	Reasonably probable	**Tolerable**	None proposed	**Tolerable**
	Recreational vessels	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
	Fishing vessels in transit	Negligible	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
Effects on vessel routeing and / or displacement – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels in transit	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
Increased vessel to vessel collision risk – OWF sites including interconnector and array cables	Commercial vessels	Minor	Reasonably probable	**Tolerable**	Management of construction traffic.	**Tolerable with mitigation**
	Recreational vessels and fishing vessels in transit	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
Increased vessel to vessel collision risk – offshore cable corridor	Commercial vessels	Minor	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels and fishing vessels in transit	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
Increased vessel to structure allision risk – OWF sites including interconnector and	Commercial vessels	Minor	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Minor	Negligible	**Broadly acceptable**	None proposed	**Broadly acceptable**

Potential Impact	Receptor	Severity of Consequence	Frequency	Significance	Additional Mitigation	Residual Impact
array cables	Fishing vessels in transit	Moderate	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
Increased vessel to structure allision risk – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels transit	No impact	No impact	**No impact**	N/A	**No impact**
Anchor interaction and snagging risk – OWF sites including interconnector and array cables	Commercial vessels and fishing vessels in transit	Minor	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Negligible	Negligible	**Broadly acceptable**	None proposed	**Broadly acceptable**
Anchor interaction and snagging risk – offshore cable corridor	Commercial vessels and fishing vessels in transit	Minor	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Negligible	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
Diminishing emergency response resources – OWF sites including interconnector and array cables	All sea users	Moderate	Remote	**Tolerable**	Effective emergency response planning and self-help capabilities including compliance with MGN 543, development of an ERCoP; and a gap analysis to identify resources which may be required.	**Tolerable with mitigation**

Potential Impact	Receptor	Severity of Consequence	Frequency	Significance	Additional Mitigation	Residual Impact
Diminishing emergency response resources – offshore cable corridor	All sea users	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
Operation and maintenance						
Effects on vessel routeing and / or displacement – OWF sites including interconnector and array cables	Commercial vessels	Minor	Reasonably probable	**Tolerable**	None proposed	**Tolerable**
	Recreational vessels	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
	Fishing vessels in transit	Negligible	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
Effects on vessel routeing and / or displacement – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels transit	No impact	No impact	**No impact**	N/A	**No impact**
Increased vessel to vessel collision risk – OWF sites including interconnector and array cables	Commercial vessels	Minor	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels and fishing vessels in transit	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
Increased vessel to vessel collision risk – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels in transit	No impact	No impact	**No impact**	N/A	**No impact**
Increased vessel to structure allision risk –	Commercial vessels	Minor	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**

Potential Impact	Receptor	Severity of Consequence	Frequency	Significance	Additional Mitigation	Residual Impact
OWF sites including interconnector and array cables	Recreational vessels	Moderate	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Fishing vessels in transit	Moderate	Remote	**Tolerable**	Further mitigation may be required depending upon foundation type selected.	**Tolerable**
Increased vessel to structure allision risk – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels transit	No impact	No impact	**No impact**	N/A	**No impact**
Anchor interaction and snagging risk – OWF sites including interconnector and array cables	Commercial vessels	Negligible	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Negligible	Negligible	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Fishing vessels in transit	Minor	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
Anchor interaction and snagging risk – offshore cable corridor	Commercial vessels and fishing vessels in transit	Minor	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Negligible	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
Diminishing emergency response resources – OWF sites including interconnector and array cables	All sea users	Minor	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**

Potential Impact	Receptor	Severity of Consequence	Frequency	Significance	Additional Mitigation	Residual Impact
Diminishing emergency response resources – offshore cable corridor	All sea users	No impact	No impact	**No impact**	N/A	**No impact**
Decommissioning						
Effects on vessel routeing and / or displacement – OWF sites including interconnector and array cables	Commercial vessels	Minor	Reasonably probable	**Tolerable**	None proposed	**Tolerable**
	Recreational vessels	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
	Fishing vessels in transit	Negligible	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
Effects on vessel routeing and / or displacement – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels transit	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**
Increased vessel to vessel collision risk – OWF sites including interconnector and array cables	Commercial vessels	Minor	Reasonably probable	**Tolerable**	Management of construction traffic including the use of control measures for construction traffic such as entry/exit points.	**Tolerable with mitigation**
	Recreational vessels and fishing vessels in transit	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**

Potential Impact	Receptor	Severity of Consequence	Frequency	Significance	Additional Mitigation	Residual Impact
Increased vessel to vessel collision risk – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels in transit	No impact	No impact	**No impact**	N/A	**No impact**
Increased vessel to structure allision risk – OWF sites including interconnector and array cables	Commercial vessels	Minor	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Minor	Negligible	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Fishing vessels in transit	Moderate	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
Increased vessel to structure allision risk – offshore cable corridor	Commercial vessels, recreational vessels and fishing vessels transit	No impact	No impact	**No impact**	N/A	**No impact**
Anchor interaction and snagging risk – OWF site including interconnector and array cables	Commercial vessels and fishing vessels in transit	Minor	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Negligible	Negligible	**Broadly acceptable**	None proposed	**Broadly acceptable**
Anchor interaction and snagging risk – offshore cable corridor	Commercial vessels and fishing vessels in transit	Minor	Remote	**Broadly acceptable**	None proposed	**Broadly acceptable**
	Recreational vessels	Negligible	Extremely unlikely	**Broadly acceptable**	None proposed	**Broadly acceptable**

Potential Impact	Receptor	Severity of Consequence	Frequency	Significance	Additional Mitigation	Residual Impact
Diminishing emergency response resources – OWF sites including interconnector and array cables	All sea users	Moderate	Remote	**Tolerable**	Effective emergency response planning and self-help capabilities	**Tolerable with mitigation**
Diminishing emergency response resources – offshore cable corridor	All sea users	No perceptible effect	No perceptible effect	**No perceptible effect**	None proposed	**No perceptible effect**

34.2.9 Chapter 16 Aviation and Radar

39. The aviation interests considered of relevance to Norfolk Vanguard include those of the UK Civil Aviation Authority (CAA), Ministry of Defence (MoD), regional airports, local aerodromes and National Air Traffic Service (NATS) (that currently comprises NATS (En-Route) plc [NERL] and NATS (Services) Limited [NSL]), other UK aviation stakeholders and, where necessary, overseas authorities. The assessment includes a description of the potential effects on aviation activities with respect to effects on radar and physical effects in both UK and overseas airspace.

40. In assessing the significance of impacts on aviation operations, the aviation industry is highly regulated and subject to numerous mandatory standards, checks and safety requirements. The sensitivity and magnitude of the impact on operations can only be identified by the appropriate aviation organisation conforming to the Risk Classification Scheme used to quantify and qualify the severity and likelihood of a hazard occurring. The Risk Classification Scheme is a fundamental element of an aviation organisation's Safety Management System (SMS), which must be acceptable to, and approved by, the UK CAA or the Military Aviation Authority (MAA), as appropriate. As such, for the purposes of the Aviation and Radar assessment, no detailed grading has been made of the magnitude of the impact or sensitivity of the receptor on the basis that any potential reduction in aviation safety cannot be tolerated. Instead, definitions of basic significance have been identified.

41. **No significant impacts** were identified for Norfolk Vanguard following implementation of appropriate mitigation (i.e. charting, marking and lighting of all wind turbines consistent with UK regulations) and radar mitigation to be agreed with the Ministry of Defence (MOD).

Table 34.9 Potential impacts identified for aviation

Potential Impact	Receptor	Significance	Additional Mitigation	Residual Impact
Construction				
Creation of an aviation obstacle	Oil and Gas platform operators and the use of specific helicopter operations to / from offshore oil and gas platforms	Not significant	Co-existence agreements where necessary.	**Not significant**
Wind turbines causing permanent interference to civil and military radar	NATS Cromer Primary Surveillance Radar (PSR) MoD Trimingham Air Defence Radar (ADR)	No change	None proposed	**No change**
Increased air traffic in the area related to wind farm activities	Helicopters operating in support of Norfolk Vanguard	Not significant	None proposed	**Not significant**
Operation				
Creation of an aviation obstacle	Oil and Gas platform operators and the use of specific helicopter operations to / from offshore oil and gas platforms	Not significant	Co-existence agreements where necessary.	**Not significant**
Wind turbines causing permanent interference to civil and military radar	NATS Cromer PSR MoD Trimingham ADR	Major Significance	A mitigation agreement between Norfolk Vanguard Limited and NATS will remove any impact to the Cromer PSR subject to regulatory approval of the TMZ solution by the CAA. Consultation with the MoD (DIO) is continuing, mitigation of the Trimingham ADR will be agreed with the MoD which will remove the impact	**Not significant**

Potential Impact	Receptor	Significance	Additional Mitigation	Residual Impact
			created by Norfolk Vanguard.	
Increased air traffic in the area related to wind farm activities	Helicopters operating in support of Norfolk Vanguard	Not significant	None proposed	**Not significant**
Decommissioning				
Creation of an aviation obstacle	Oil and Gas platform operators and the use of specific helicopter operations to / from offshore oil and gas platforms	Not significant	Co-existence agreements where necessary.	**Not Significant**
Wind turbines causing permanent interference to civil and military radar	NATS Cromer PSR MoD Trimingham ADR	No change	Technical mitigation for the impacts of wind turbine detectability by radar systems will remain operational until the last wind turbine is decommissioned and incapable of rotation.	**No change**
Increased air traffic in the area related to wind farm activities	Helicopters operating in support of Norfolk Vanguard	Not significant	None proposed	**Not significant**

34.2.10 Chapter 17 Offshore Archaeology and Cultural Heritage

42. The existing offshore and intertidal archaeological baseline has been established through a desk-based assessment and a review of site specific geophysical survey data collected in 2016.

43. Through the implementation of embedded mitigation, the effects on offshore archaeology associated with construction, O&M and decommissioning are anticipated to result in impacts of **negligible** or **minor adverse** significance. Embedded mitigation measures include Archaeological Exclusion Zones (AEZs) to avoid important archaeological features, ensuring that direct impacts will not occur as well as watching briefs during intrusive works where sediment is brought to the surface. No works in the intertidal zone will be undertaken due to the commitment to undertake long HDD and a watching brief would be carried out during the HDD works.

44. Mitigation measures will be developed within the framework of a Written Scheme of Investigation (WSI), in consultation with Historic England and the MMO. A draft outline WSI (document reference 8.6) setting out the principles for all proposed embedded mitigation is submitted alongside the DCO application for the project.

Table 34.10 Potential Impacts Identified for offshore and intertidal archaeology

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction						
Direct impact to known heritage assets	Wrecks and Anomalies (A1)	High	High	**Major adverse**	50m AEZs	**No impact**
	A3 wrecks	High	High	**Major adverse**	Avoidance through micrositing	**No impact**
	Additional anomalies (A2)	High	High	**Major adverse**	Avoid through micrositing where possible	**No impact**
	Intertidal assets	Low	No impact	**No impact**	N/A	**No impact**
Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	High	High	**Major adverse**	Further pre-construction assessment to be conducted	**Minor adverse**
	In situ intertidal sites	High	Negligible	**Minor adverse**	Further pre-construction (geoarchaeological) assessment to be conducted	**Minor adverse**
	Isolated finds	Medium	Low	**Minor adverse**	Protocol to be established in line with WSI	**Minor adverse**
Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Low to High	Negligible	**Negligible to Minor**	None proposed	**Negligible to Minor adverse/ beneficial**
Impacts to the setting of heritage assets and historic seascape character	Temporary changes to maritime and military setting of wrecks and to the historic seascape character from construction activities. The presently perceived historic character is considered to have a high capacity to accommodate changes associated with construction.					
Impacts to site preservation conditions from drilling fluid breakout	Intertidal assets	Low	**Negligible / No impact**	**Negligible**	None proposed	**Negligible**
Operation						

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Direct impact to known heritage assets	As for construction					**No impact**
Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	High	High	**Major adverse**	Further pre-construction assessment to be conducted	**Minor adverse**
Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Low to High	Negligible	**No impact to Negligible**	None proposed	**No impact to Negligible**
Impacts to the setting of heritage assets and historic seascape character	Change to maritime and military setting of wrecks and to the historic seascape character during operation. The presently perceived historic character is considered to have a high capacity to accommodate changes associated with operation.					
Impacts to site preservation conditions from heat loss from installed cables	Known and potential heritage assets	Low to High	No impact	**No impact**	N/A	**No impact**
Decommissioning						
Direct impact to known heritage assets	As for construction					**No impact**
Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	High	High	**Major adverse**	Further pre-construction assessment to be conducted	**Minor adverse**
Indirect impact to heritage assets from changes to physical processes	As for construction (or less)					**Negligible to Minor adverse/ beneficial**
Impacts to the setting of heritage assets and historic seascape character	Temporary changes to maritime and military setting of wrecks and to the historic seascape character from decommissioning activities. The presently perceived historic character is considered to have a high capacity to accommodate changes associated with decommissioning.					
Cumulative						
Direct impact to known heritage assets	*In situ* prehistoric, maritime or aviation sites	Low to High	High	**Major adverse**	Avoidance through micrositing where	**No impact**

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
					possible	
Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	Medium to High	High	**Major adverse**	Further pre-construction assessment to be conducted/reporting protocol to be established in line with WSI	**Minor adverse (plus positive benefit from accumulation of data)**
Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Low to High	Negligible	**No impact**	N/A	**No impact**
Impacts to the setting of heritage assets and historic seascape character	Within 100km of Norfolk Vanguard (and across the southern North Sea as a whole), cumulative impacts to the setting of heritage assets and historic seascape character will occur. Whether this is considered adverse/beneficial depends upon individual perceptions of a seascape associated with offshore renewables as a negative or positive change.					
Transboundary						
Direct impact to known heritage assets	Wrecks or aircraft of non-British origin	High	High	**Major adverse**	Avoidance through micrositing where possible	**No impact**
Direct impact to potential heritage assets	Wrecks or aircraft of non-British origin	High	High	**Major adverse**	Further pre-construction assessment to be conducted/reporting protocol to be established in line with WSI consideration of legal status in country of origin	**Minor adverse**
	Prehistoric, maritime and aviation archaeological resource (across national boundaries)	Medium to High	High	**Major adverse**	Further pre-construction assessment to be conducted/reporting protocol to be established in line with	**Minor adverse (plus positive benefit from accumulation of data)**

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
					WSI	
Indirect impact to heritage assets from changes to physical processes	Tidal ellipses show that all movement is in a north south direction so will not cross the international boundary and transboundary impacts will not occur.					

34.2.11 Chapter 18 Infrastructure and Other Users

45. This assessment considered offshore wind farm projects, oil and gas activity, marine aggregate extraction, marine disposal sites, military exercise areas (note military aviation is addressed in Chapter 16 Aviation and Radar), telecommunications and electricity cables, pipelines, port developments, capital and maintenance dredging, a coal and brine consultation area and unexploded ordnance (UXO).

46. Potential impacts during construction, O&M and decommissioning include impacts on subsea cable and pipelines, aggregate dredging activities disposal sites, and oil and gas exploration and production and these were assessed as **negligible** to **minor adverse** significance. Agreements with relevant operators would be put in place as embedded mitigation and ongoing consultation with developers would ensure impacts would remain of low significance.

Table 34.11 Potential impacts identified for infrastructure and other users

Potential Impact	Value/ Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction					
Impacts on subsea cables and pipelines	High	Negligible	**Minor**	Agreements with operators would be put in place as embedded mitigation	**Minor**
Impacts on aggregate dredging activities	Negligible	Negligible	**Negligible**	None proposed	**Negligible**
Impacts on disposal sites	Negligible	Negligible	**Negligible**	None proposed	**Negligible**
Impacts on oil and gas exploration and production	Low	Low	**Minor**	Ongoing consultation with developers	**Minor**
Operation					
Scoped out (see Royal HaskoningDHV, 2016)					
Decommissioning					
Subsea cables and pipelines	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 and operators of cables for which there are crossing agreements. 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.				

34.3 Onshore

47. The ES covers a wide range of onshore physical, ecological and human receptors in respect of the onshore environment, for which potential impacts have been assessed.

34.3.1 Chapter 19 Ground Conditions and Contamination

48. The majority of the onshore project area is located in agricultural land, where significant contamination is not expected. The ground conditions assessment included a desk-based review of the current conditions found within the onshore project area, and identified mitigation measures where appropriate for those significant effects that may potentially arise as part of the project.

49. The impacts assessed include the potential for contamination leaks and spills from construction plant, potential for existing contaminant release during any works and impacts on groundwater quality and mineral resources availability. A Code of Construction Practice (COCP) will be produced for each stage of construction (in accordance with the draft COCP (document 8.1) submitted with the DCO application), which will provide details of the industry best practice measures that would be undertaken to reduce potential construction impacts onshore.

50. Provided mitigation measures (both embedded and additional as required) are implemented to prevent ground and groundwater pollution and interconnection of aquifer units in the footprint of the project, the project is predicted to have **minor adverse** impacts in relation to ground conditions and contamination.

Table 34.12 Potential impacts identified for ground conditions and contamination

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Additional Mitigation	Residual impact
Construction						
Impacts to coastline, including designated geological sites	Coastline and designated geological sites	High	Negligible	**Negligible**	None	**Negligible**
Impacts of construction may cause contamination of secondary aquifers	Secondary aquifers	Low - Medium	Medium	**Minor - Moderate adverse**	CoCP - minimise exposure to potentially harmful substances	**Minor adverse**
Impacts of open cut trench construction may affect the groundwater quality of the Principal aquifer including at SPZ areas	Principal Aquifer including at SPZ areas	High	Low	**Moderate adverse**	CoCP - minimise exposure to potentially harmful substances	**Minor adverse**
Impacts of trenchless crossing technique conduit construction and piling may affect the groundwater quality of the Principal Aquifer, including conduit construction within an SPZ areas.	Principal Aquifer including at SPZ areas	Low	High	**Moderate adverse**	Hydrogeological risk assessment to be conducted pre-construction	**Minor adverse**
Impacts of construction may affect the quantity and quality of surface waters fed by groundwater	Surface water	Low-high	Low	**Minor adverse**	Embedded mitigation only	**Minor adverse**
Impacts to human health, including construction	Human health.	High	Low	**Moderate adverse**	CoCP – Site and Excavated Waste	**Minor adverse**

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Additional Mitigation	Residual impact
workers and general public during any excavations associated with construction.					Management Plan	
Sterilisation of mineral resources.	Mineral safeguard areas.	Medium	High	**Major adverse**	CoCP – Materials Management Plan	**Minor adverse**
Impacts on shallow groundwater due to changes to the hydraulic regime as a result of the construction works	Shallow groundwater	Low	Low	**Minor adverse**	Embedded mitigation only	**Minor adverse**
Operation						
Impacts during operation are scoped out of the ES in accordance with the Norfolk Vanguard EIA Scoping Report.						
Decommissioning						
It is anticipated that the decommissioning impacts will be similar in nature to those of construction.						

34.3.2 Chapter 20 Water Resources and Flood Risk

51. The ground conditions assessment included a desk-based review of the current conditions found within the onshore project area. The assessment was categorised by three main surface water catchments: the River Bure catchment, the River Wensum catchment, and the River Wissey catchment. The River Bure and River Wensum are designated as a Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI), and several of their tributaries, including the King's Beck, North Walsham and Dilham Canal, Wendling Beck and Blackwater Drain will be crossed by the proposed onshore cable route. The proposed grid connection at the existing Necton National Grid substation will be located within the River Wissey headwaters. Due to the designated status of the River Bure and River Wensum, these watercourses and their tributaries are considered to be receptors of high value.

52. The impact assessment considered potential impacts upon receptors including direct disturbance of surface water bodies, increased flood risk, increased sediment input to watercourses, and accidental spills of fuels, oils and lubricants during construction.

53. **Moderate adverse** residual impacts are predicted on the River Bure catchment and River Wensum catchment as a worst case where permanent culverts are used, and due to increased sediment supply when assessed on a worse case sub-catchment basis. It is important to note that this assessment is based on the cumulative effect of multiple crossings within each sub-catchment, rather than the impacts associated with any single crossing. Whilst the worst case of permanent culverts are considered to result in some significant impacts, where permanent culverts can be avoided any changes occur as a result of temporary crossings will be temporary and reversible and, with mitigation would not result in significant residual impacts.

54. Following implementation of mitigation, all other assessed impacts for water resources and flood risk are **negligible** to **minor adverse**.

Table 34.13 Potential impacts identified for water resources and flood risk

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Construction							
Impact 1: Direct disturbance of surface water bodies	River Bure catchment	North Walsham and Dilham Canal	Low / Low	Low	**Minor adverse**	CoCP – including dam and divert	**Negligible**
		East Ruston Stream	High / High	Low	**Moderate adverse**	CoCP – including dam and divert	**Minor adverse**
		New Cut	High / Low	N/A	**No impact**	N/A	**N/A**
		River Bure	High / Medium	Medium	**Major adverse**	CoCP – including dam and divert	**Moderate adverse**
		King's Beck	High / Medium	Medium	**Major adverse**	CoCP – including dam and divert	**Moderate adverse**
		Mermaid Stream	High / Medium	N/A	**No impact**	N/A	**N/A**
	River Wensum catchment	River Wensum	High / High	Negligible	**Minor adverse**	CoCP – including dam and divert	**Minor adverse**
		Blackwater Drain	High / High	High	**Major adverse**	CoCP – including dam and divert	**Moderate adverse**
		Wendling Beck	High / High	Medium	**Major adverse**	CoCP – including dam and divert	**Moderate adverse**
		Penny Spot Beck	High / High	Medium	**Major adverse**	CoCP –	**Minor adverse**

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
						including dam and divert	
	River Wissey catchment	Upper River Wissey	Medium / Medium	Medium	**Moderate adverse**	CoCP – including dam and divert	**Minor adverse**
Impact 2: Increased sediment supply	River Bure catchment	North Walsham and Dilham Canal	Low / Low	Negligible	**Negligible**	CoCP – sediment management	**Negligible**
		East Ruston Stream	High / High	Low	**Moderate adverse**	CoCP – sediment management	**Moderate adverse**
		New Cut	High / Low	Negligible	**Minor adverse**	CoCP – sediment management	**Minor adverse**
		River Bure	High / Medium	Low	**Moderate adverse**	CoCP – sediment management	**Moderate adverse**
		King's Beck	High / Medium	Negligible	**Minor adverse**	CoCP – sediment management	**Minor adverse**
		Mermaid Stream	High / Medium	Negligible	**Minor adverse**	CoCP – sediment management	**Minor adverse**
	River Wensum catchment	River Wensum	High / High	Negligible	**Minor adverse**	CoCP – sediment management	**Minor adverse**
		Blackwater Drain	High / High	Low	**Moderate**	CoCP –	**Moderate**

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
					adverse	sediment management	**adverse**
		Wendling Beck	High / High	Low	**Moderate adverse**	CoCP – sediment management	**Moderate adverse**
	River Wissey catchment	Upper River Wissey	Medium / Medium	Low	**Minor adverse**	CoCP – sediment management	**Minor adverse**
Impact 3: Accidental release of fuels, oils, lubricants, foul waters and construction materials	River Bure catchment	North Walsham and Dilham Canal	Low / Low	Low	**Minor adverse**	CoCP – pollution prevention	**Negligible**
		East Ruston Stream	High / High	Medium	**Major adverse**	CoCP – pollution prevention	**Minor adverse**
		New Cut	High / Low	Low	**Moderate adverse**	CoCP – pollution prevention	**Minor adverse**
		River Bure	High / Medium	Medium	**Major adverse**	CoCP – pollution prevention	**Minor adverse**
		King's Beck	High / Medium	Low	**Moderate adverse**	CoCP – pollution prevention	**Minor adverse**
		Mermaid Stream	High / Medium	Low	**Moderate adverse**	CoCP – pollution prevention	**Minor adverse**
	River Wensum	River Wensum	High / High	Low	**Moderate**	CoCP –	**Minor adverse**

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
	catchment				**adverse**	pollution prevention	
		Blackwater Drain	High / High	Medium	**Major adverse**	CoCP – pollution prevention	**Minor adverse**
		Wendling Beck	High / High	Medium	**Major adverse**	CoCP – pollution prevention	**Minor adverse**
	River Wissey catchment	Upper River Wissey	Medium / Medium	Low	**Minor adverse**	CoCP – pollution prevention	**Minor adverse**
	Groundwater	Principal Aquifer	High / High	Medium	**Major adverse**	CoCP – pollution prevention	**Minor adverse**
Impact 4: Increased surface water runoff and flood risk	River Bure catchment	North Walsham and Dilham Canal	Low / Low	Low	**Minor adverse**	CoCP – Surface Water Drainage Plan	**Negligible**
		East Ruston Stream	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		New Cut	High / Low	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		River Bure	High / Medium	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		King's Beck	High / Medium	Low	**Moderate**	CoCP – Surface	**Minor adverse**

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
					adverse	Water Drainage Plan	
		Mermaid Stream	High / Medium	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
	River Wensum catchment	River Wensum	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		Blackwater Drain	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		Wendling Beck	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
	River Wissey catchment	Upper River Wissey	Medium / Medium	Medium	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
Operation							
Impact 1: Increased surface water runoff, altered groundwater flows, and changes to flood risk	River Bure and Wensum catchments	North Walsham and Dilham Canal	Low / Low	Low	**Minor adverse**	CoCP – Surface Water Drainage Plan	**Negligible**
		East Ruston Stream	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		New Cut	High / Low	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
		River Bure	High / Medium	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		King's Beck	High / Medium	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		Mermaid Stream	High / Medium	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		River Wensum	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		Blackwater Drain	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
		Wendling Beck	High / High	Low	**Moderate adverse**	CoCP – Surface Water Drainage Plan	**Minor adverse**
	River Wissey catchment	Upper River Wissey	Medium / Medium	Low	**Minor adverse**	CoCP – Surface Water Drainage Plan	**Negligible**
	Groundwater bodies		High / High	Low	**Minor adverse**	CoCP – Surface Water Drainage Plan	**Negligible**
Impact 2: Supply of fine sediment and other contaminants	River Bure catchment	North Walsham and Dilham Canal	Low / Low	Negligible	**Negligible**	None proposed	**Negligible**
		East Ruston	High / High	Negligible	**Minor adverse**	None	**Minor adverse**

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
		Stream				proposed	
		New Cut	High / Low	Negligible	**Minor adverse**	None proposed	**Minor adverse**
		River Bure	High / Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
		King's Beck	High / Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
		Mermaid Stream	High / Medium	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	River Wensum catchment	River Wensum	High / High	Negligible	**Minor adverse**	None proposed	**Minor adverse**
		Blackwater Drain	High / High	Negligible	**Minor adverse**	None proposed	**Minor adverse**
		Wendling Beck	High / High	Negligible	**Minor adverse**	None proposed	**Minor adverse**
	River Wissey catchment	Upper River Wissey	Medium / Medium	Low	**Minor adverse**	Substation Surface Water Drainage Plan and Pollution Prevention	**Minor adverse**
	Groundwater bodies		High / High	Negligible	**Minor adverse**	Substation Surface Water Drainage Plan and Pollution Prevention	**Minor adverse**
Decommissioning							

Potential Impact	Receptor	Sub-catchment	Value / Sensitivity	Magnitude	Significance	Additional Mitigation	Residual Impact
Impacts no worse than those during construction							

34.3.3 Chapter 21 Land Use and Agriculture

55. To inform the land use and agriculture impact assessment, a desk-based literature review of existing reports and survey data was undertaken to provide indicative baseline conditions for land use. Additionally, consultation has been undertaken with relevant Local Planning Authorities and feedback has been sought from landowners and occupiers within the study area to provide information on agricultural practices.

56. The assessment considered the potential impacts of the project on drainage, agricultural land, soil quality, Environmental Stewardship Schemes and utilities. Provided mitigation measures are in place, the project is predicted to have no greater than **minor adverse** impacts in relation to land use and agriculture. Mitigation measures include the use of an Agricultural Liaison Officer, ensuring agricultural field drains are maintained, and employing best practice measures through a Soils Management Plan (SMP).

Table 34.14 Potential impacts identified for land use and agriculture

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
Construction						
	Drainage	Medium	Low	Minor adverse	CoCP - Drainage contractor, Drainage Plan, SMP	**Negligible**
	Land taken out of existing use	Medium	Medium	Moderate adverse	CoCP - SMP, commercial agreements with relevant landowners/occupiers	**Minor adverse**
	Degradation of natural resources - soil	Low	Low	Minor adverse	CoCP - SMP, private agreements	**Negligible**
	Erosion of soil	Low	Medium	Minor adverse	CoCP – commercial agreements with relevant landowners/occupiers	**Negligible**
	ESS	Medium	Negligible	Minor adverse	CoCP – commercial agreements with relevant landowners/occupiers	**Negligible**
	Utilities	N/A.	N/A	No impact	N/A	**No impact**
Operation						
	Drainage	N/A	N/A	No impact	N/A	**No impact**
	Permanent land use change	Medium	Low	Minor adverse	Private agreements	**Negligible**
	ESS	N/A.	N/A	Negligible	None proposed	**Negligible**
	Utilities	N/A	N/A	No impact	N/A	**No impact**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
Decommissioning						
It is anticipated that the decommissioning impacts will be no worse than those for construction.						

34.3.4 Chapter 22 Onshore Ecology

57. The Onshore Ecology assessment has been informed by an extensive suite of ecological surveys, undertaken throughout 2017 to describe the ecological baseline. The scope of these surveys was agreed in advance with Natural England.

58. It was not possible to survey the entire onshore project area due to landowner access restrictions, impenetrable habitat or other restrictions and therefore, the assessment has been supplemented by a desk-based study. For areas where project specific survey data is not available due to access restrictions, a precautionary approach has been adopted, i.e. it has been assumed that protected or notable species will be present within areas where suitable habitat is present. In these instances, an assessment of the habitat and its suitability to support protected or notable species has been made using either the findings from the Extended Phase 1 Habitat Survey or from reviewing the Norfolk Living Map data. Any impacts concluded for the unsurveyed areas are, therefore, considered to be the worst case.

59. Impacts assessed include direct and indirect effects on designated sites, habitats and species. Key receptors identified within the onshore project area and zone of influence are listed in Table 34.15. The potential significance in surveyed areas is deemed to be **negligible** or **minor adverse** for most species following mitigation. Potential **moderate adverse** impacts have been identified for bats and hedgerows, however, these impacts will reduce over time as replacement hedgerows mature.

60. In unsurveyed areas, the potential significance is also deemed to be **negligible** or **minor adverse** for most species following mitigation (or **no impact** for receptors which are either not present or would be avoided through embedded mitigation). Potential **moderate adverse** impacts have been identified for bats and great crested newts. For all unsurveyed areas where potential impacts have been identified, pre-construction ecological surveys will be undertaken and, where the presence of these species is confirmed, appropriate mitigation measures would be developed, adhering to Natural England Standing Advice, to reduce impacts.

61. Potential impacts during operation may arise as a result of maintenance and operational lighting at the onshore project substation. Operational lighting will be designed to conform with best practice guidance to minimise disturbance to light-sensitive species and reduce these impacts to **negligible**.

62. Mitigation measures would be developed in consultation with the relevant SNCB and Planning Authority through the Ecological Management Plan (Requirement [24] of the DCO Schedule 1 Part 3) in accordance with the Outline Landscape and

Environmental Management Strategy (OLEMS) (document 8.7) submitted with the DCO application.

Table 34.15 Potential impacts identified for onshore ecology

Potential Impact	Receptor	Importance	Significance[1] Surveyed areas	Significance[1] Unsurveyed areas	Additional Mitigation	Residual Impact Surveyed areas	Residual Impact Unsurveyed areas
Construction							
1	Statutory designated sites	High	**Moderate adverse**	**N/A**	OLEMS – including hedgerow replacement	**Minor adverse**	**N/A**
2	Non-statutory designated sites	Medium	**Minor adverse**	**N/A**	OLEMS – including hedgerow replacement	**Negligible**	**N/A**
3	Arable land	High	**Moderate adverse**	**N/A**	OLEMS – reinstatement of arable field margins	**Minor adverse**	**N/A**
4	Woodland, trees and scrub	High	**Negligible**	**N/A**	OLEMS – tree protection	**Negligible**	**N/A**
5	Hedgerows	High	**Moderate adverse**	**N/A**	OLEMS – hedgerow replacement	**Moderate adverse**	**N/A**
6	Grassland	High	**Minor adverse**	**N/A**	OLEMS – reinstatement	**Minor adverse**	**N/A**
7	Coastal habitats	High	**No impact**	**N/A**	N/A	**No impact**	**N/A**
8	Watercourses and ponds	High	**Moderate adverse**	**N/A**	OLEMS – reinstatement	**Minor adverse**	**N/A**
9	Badgers	Low	**Minor adverse**	**Minor adverse**	OLEMS –	**Minor adverse**	**Minor adverse**

[1] Significance is presented for both the impacts predicted based on survey data obtained to date and for the potential impacts which may arise if it is assumed that a receptor is present within the unsurveyed areas. Where the data obtained to date is adequate to fully described the ecological baseline, 'N/A' is presented within the 'unsurveyed' columns.

Potential Impact	Receptor	Importance	Significance[1]		Additional Mitigation	Residual Impact	
			Surveyed areas	Unsurveyed areas		Surveyed areas	Unsurveyed areas
					Agreement with NE		
10	Bats	High	**Major adverse**	**Major adverse**	OLEMS – hedgerow replacement	**Moderate adverse**	**Moderate adverse**
11	Water vole	Medium	**Moderate adverse**	**Moderate adverse**	OLEMS - displacement	**Minor adverse**	**Minor adverse**
12	Otter	High	**Minor adverse**	**N/A**	OLEMS – introduction of mammal ramps	**Minor adverse**	**N/A**
13	Great crested newts	High	**Minor adverse**	**Major adverse**	OLEMS – updated surveys and adherence to NE standing advice	**Minor adverse**	**Moderate adverse**
14	Reptiles	Medium	**Minor adverse**	**Moderate adverse**	OLEMS – Precautionary Method of Working	**Minor adverse**	**Minor adverse**
15	White-clawed crayfish	High	**No impact**	**N/A**	N/A	**No impact**	**N/A**
16	Other invertebrates	High	**No impact**	**Moderate adverse**	OLEMS – pre-construction survey of River Wensum. Reinstatemen	**No impact**	**Minor adverse**

Potential Impact	Receptor	Importance	Significance[1]		Additional Mitigation	Residual Impact	
			Surveyed areas	Unsurveyed areas		Surveyed areas	Unsurveyed areas
					t of habitats		
17	Fish	High	**Moderate adverse**	**N/A**	OLEMS – survey and monitoring	**Minor adverse**	**N/A**
18	Protected flora	High	**No impact**	**N/A**	N/A	**No impact**	**N/A**
19	Invasive non-native species	Medium	**Moderate adverse**	**Moderate adverse**	CoCP - Invasive Species Management Plan	**Minor adverse**	**Minor adverse**
Operation							
1	Habitat and species during maintenance	High	**Minor adverse**	**N/A**	N/A	**Negligible**	**N/A**
2	Fauna during operational lighting and noise	High	**Minor adverse**	**N/A**	N/A	**Negligible**	**N/A**
Decommissioning							
Impacts similar to those during construction							

34.3.5 Chapter 23 Onshore Ornithology

63. Information was gathered through a combination of desk-based assessment and a programme of field surveys (wintering bird and breeding bird surveys) of the onshore study area conducted between 2016 and 2017.

64. The potential for temporary habitat and disturbance of birds during construction was assessed, along with potential noise and light disturbance during operation associated with the onshore project substation.

65. Provided mitigation measures are in place, the project is predicted to have no greater than **minor adverse** impacts in relation to onshore ornithology. Mitigation measures include removing vegetation prior to bird breeding seasons, reinstatement of removed hedgerows following construction, and an operational lighting scheme at the onshore project substation that conforms to guidance set out in the Bat Conservation Trust's *Artificial Lighting And Wildlife Guidance*.

Table 34.16 Potential impacts identified for onshore ornithology

Potential Impact	Receptor	Importance	Magnitude	Significance	Mitigation	Residual Impact
Construction						
1	Statutory designated sites	Low	Medium	**Minor adverse**	OLEMS – reinstatement of habitats	**Minor adverse**
2	Wintering / on passage bird species	Medium	Low	**Minor adverse**	OLEMS - reinstatement of habitats and timing of works in certain areas for lapwing	**Minor adverse**
3	Breeding bird species	Medium	Medium	**Moderate adverse**	OLEMS – reinstatement of habitats and set aside areas for ground nesting species	**Minor adverse**
Operation						
1	Habitat and species during maintenance	Medium	Negligible	**Negligible**	N/A	**Negligible**
2	Bird species during operational lighting and noise	Medium	Negligible	**Negligible**	Yes	**Negligible**
Decommissioning						
Impacts similar to those during construction						

34.3.6 Chapter 24 Traffic and Transport

66. The traffic and transport assessment for the project is based on forecasts of background levels of traffic for 2022 as this represents the main construction year. Transport requirements were determined through a series of desk based assessments utilising open source data obtained from the Department for Transport and the relevant Highway Authorities. Further traffic data was obtained via commissioned onsite Automatic Traffic Count surveys undertaken in 2017.

67. A total of 86 highway links within the traffic and transport study area have been assessed for the effects of severance, pedestrian amenity, road safety and driver delay. With the application of mitigation measures (as appropriate) the residual impact for all highway links (bar link 69) was assessed to be **negligible** or **minor adverse**.

68. Link 69 has a mitigated traffic demand of 48 daily HGV movements and the effect is considered to be of low magnitude. However, noting the high sensitivity of the receptor, due to it not supporting two-way traffic, it is expected that the residual impact significance would be marginally **moderate adverse**. The assessed impact is very localised and is for a relative short duration and reversible.

69. In accordance with Requirement [21] of DCO Schedule 1 Part 3, a Traffic Management Plan and Travel Plan will contain specific commitments to managing the HGV movements on link 69 and the need for continued community engagement. An Outline Traffic Management Plan (document 8.8) and Outline Travel Plan (document 8.9) have been submitted with the DCO application.

Table 34.17 Potential impacts identified for traffic and transport

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Construction						
Impact 1: Pedestrian Severance	Links: 6, 8, 9, 10, 13a, 13b, 14, 16, 17, 18, 19, 21, 22, 24, 25, 29, 30, 32, 33, 34, 35a, 35b, 36, 37, 40a, 40b, 41, 42, 44a, 44b, 45, 46, 47b, 47c, 49, 52, 53, 54, 55, 56, 57, 58, 59, 60, 64, 65, 66, 67, 68, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79.	Low – High	Very Low -	**Negligible - Minor adverse**	None proposed	**Negligible – Minor adverse**
	69	High	High	**Major adverse**	Specific targeted TMP measures.	**Moderate adverse**
Impact 2: Pedestrian Amenity	Links: 6, 8, 9, 10, 13a, 13b, 14, 16, 17, 18, 19, 21, 22, 24, 25, 29, 30, 32, 33, 34, 35a, 35b, 36, 37, 40a, 40b, 41, 42, 44a, 44b, 45, 46, 47b, 47c, 49, 52, 53, 54, 55, 56, 57, 58, 59, 60, 64, 65, 66, 67, 68, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79.	Low – High	Low – High	**Minor – Major adverse**	Specific targeted TMP measures.	**Minor adverse**
	69	High	High	**Major adverse**	Specific targeted TMP measures.	**Moderate adverse**

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Impact 3: Road Safety	Clusters: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	Negligible - Medium	Low - Medium	**Minor - Moderate**	Specific targeted TMP measures.	**Minor adverse**
Impact 4: Driver Delay	Junctions: 1, 2, 3, 4	High	Low - Very Low	**Minor**	None proposed	**Minor adverse**
Operation						
All impacts	All links	Low - High	Very Low	**Negligible, or up to localised minor adverse**	None proposed	**Negligible, or up to localised minor adverse**
Decommissioning						
Impacts upon those links serving the cable route works would be significantly less than the construction phase whilst impacts upon those links primarily serving the onshore project substation (link 1) would be no worse than construction. Therefore, the overall magnitude of effect would be negligible to minor adverse and where appropriate similar mitigation strategies as presented for construction would be valid.						

34.3.7 Chapter 25 Noise and Vibration

70. To inform the noise and vibration impact assessment, a baseline noise survey was undertaken to quantify the existing noise environment in the vicinity of proposed onshore assets and construction corridors. Noise modelling was undertaken to inform several subsequent assessments in order to determine any potential impacts relating to the construction and operation of the project at agreed receptors.

71. Potential impacts from noise were identified as arising from construction works in a small number of locations along the onshore cable route. Provided mitigation measures are in place, the project is predicted to have no greater than **minor adverse** impacts in relation to noise during construction.

72. The only sources of noise during the operation of the project are those associated with the onshore project substation. Norfolk Vanguard Ltd will provide a final design of the project which will not exceed the noise limits (at the nearest noise sensitive receptors) already imposed on the existing Necton substation in accordance with Requirement [27] of the DCO (Schedule 1 Part 3). Noise reduction technologies and potential design approaches have been considered as part of the assessment and there are many proven mitigation options that, through the detailed design process, can be combined to create a design that will adhere to the required noise limits.

73. During operation, there is the potential for impacts from the project to act cumulatively with Norfolk Boreas, as the two projects' onshore substations will operate simultaneously. This scenario has been modelled and the level of noise reduction required across both projects would be readily achievable. The resultant noise levels would not exceed the noise limits (at the nearest noise sensitive receptors) imposed on the existing Necton substation.

Table 34.18 Potential impacts identified for noise and vibration

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction						
Landfall Daytime	Residential	Medium	No Impact	**No Impact**	N/A	**No Impact**
Landfall Evening and weekends	Residential	Medium	No Impact	**No Impact**	N/A	**No Impact**
Landfall night-time	Residential	Medium	Minor to Major Adverse	**Minor Adverse to Major Adverse Impact**	CoCP - Construction Noise Management Plan (CNMP) + Enhanced mitigation (localised screening and increased separation distances).	**No Impact**
Onshore cable route	Residential	Medium	No Impact to Major Adverse	**No Impact to Major Adverse Impact**	CoCP - CNMP + Enhanced mitigation (localised screening and increased separation distances).	**No Impact**
Onshore project substation	Residential	Medium	No Impact to Minor (depending on export cable route option)	**No Impact to Minor Adverse Impact (depending on export cable route option)**	CoCP - CNMP + Enhanced mitigation (localised screening and increased separation distances).	**No Impact**
Traffic	Residential	Medium	Moderate Adverse	**Moderate Adverse Impact**	Measures identified within the Outline Traffic Management Plan	**Minor Adverse**
Vibration	Residential	Medium	No impact	**No impact**	N/A	**No Impact**
Operation						
Noise	Residential	Medium	Minor Adverse	**Minor Adverse**	Designed to comply with	**No Impact**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
				Impact	agreed noise limits	
Vibration	Residential	Medium	No Impact	**No Impact**	N/A	**No Impact**
Decommissioning						
Landfall Daytime	Residential	Medium	No Impact	**No Impact**	N/A	**No Impact**
Onshore cable route	Residential	Medium	No Impact to Major Adverse	**No Impact to Major Adverse Impact**	CNMP + Enhanced mitigation (localised screening and increased separation distances).	**No Impact**
Onshore project substation	Residential	Medium	No Impact to Minor (depending on export cable route option)	**No Impact to Minor Adverse Impact (depending on export cable route option)**	CNMP + Enhanced mitigation (localised screening and increased separation distances).	**No Impact**
Traffic	Residential	Medium	Moderate Adverse	**Moderate Adverse Impact**	Traffic Management Plan	**Minor Adverse Impact**
Vibration	Residential	Medium	No Impact	**No Impact**	N/A	**No Impact**

34.3.8 Chapter 26 Air Quality

74. A desk-based assessment was carried out using air quality monitoring data collected by Local Authorities within the study area, as well as pollution maps provided by the Department of Environment, Food and Rural Affairs (Defra), to establish existing pollution levels.

75. The aim of the air quality assessment is to prevent exceedance of Local Air Quality Management (LAQM) thresholds at receptors and therefore impacts should be categorised as either significant or not significant. The air quality assessment considered the potential impacts associated with onshore construction phase dust and road traffic emissions only, in accordance with the Scoping Opinion (document 6.4).

76. In accordance with air quality guidance, a suite of best-practice mitigation measures has been identified (such as dampening down the running track during dry periods to minimise dust generation), which are commensurate with the level of dust risk of the construction activities. With the implementation of the mitigation measures, dust impacts can be considered to be **not significant.**

Table 34.19 Potential impacts identified for air quality

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Construction						
1. Construction dust and fine particulate matter	Human receptors within 350m of onshore works.	Dust Soiling: Medium sensitivity Human Health: Low sensitivity	Medium	Assessment methodology does not assign significance before mitigation.	CoCP - Measures as recommended by the Institute of Air Quality Management (IAQM).	**Not significant**
2. Construction phase road traffic exhaust emissions	Residential properties, schools, hospitals and care homes within 200m of roads taking more than 100 HGVs per day.	High	The maximum increase in NO_2 concentrations at a receptor was 1.42µg.m^{-3} at receptor R30	**Overall not significant, however slight adverse impact at one receptor.**	No additional mitigation measures required.	**Not significant**
	Designated ecological sites.	High	Pollutant concentrations above 1% of Critical Load.	**Discussed in Chapter 22 Onshore Ecology**	No additional mitigation measures required.	Discussed in Chapter 22 Onshore Ecology (Not significant)
Operation						
Operational impacts on air quality have been scoped out.						
Decommissioning						
As per construction.						

34.3.9 Chapter 27 Human Health

77. The human health effects that were considered to have potential to impact on physical or mental health included: construction and operational noise, air quality, exposure to contaminated land or water, disrupted journeys or access, employment during construction and operation, exposure to electromagnetic fields (EMF) during operation, and affordability of electricity.

78. Chapter 27 therefore considers the findings of the following impact assessments, in population health terms:

- Water Resources and Flood Risk (Chapter 20 and section 34.3.2;
- Land Use and Agriculture (Chapter 21 and section 34.3.3);
- Traffic and Transport (Chapter 24 and section 34.3.6);
- Noise and Vibration (Chapter 25 and section 34.3.7);
- Air Quality (Chapter 26 and section 34.3.8);
- Landscape and Visual Impact Assessment (Chapter 29 and section 34.3.11);
- Tourism and Recreation (Chapter 30 and section 34.3.12); and
- Socio-economics (Chapter 31 and section 34.3.13);

79. The onshore infrastructure is largely routed through agricultural land and away from population centres and sensitive receptors, thus the potential number of receptors has been reduced through site selection and project design embedded mitigation.

80.

81. The buried cable systems will produce EMFs. Public Health England has produced guidelines identifying EMF thresholds above which there is the potential for human health effects. The level of EMFs produced by the Norfolk Vanguard buried cable systems is approximately 1% of the value Public Health England has identified as a safe level. As such, the conclusion of the assessment is that there would be no effect to population health due to EMFs during operation.

82. In addition, potential beneficial impacts have been identified due to an increase in local employment and training opportunities and as a result of increasing energy security in the long term, through renewable generation which may reduce electricity bills.

83. Following best practice, Chapter 27 considers health effects with regards to the general population and vulnerable population groups (Table 34.20). Vulnerable population groups include children and young people; older people; people with existing poor health; and people living in deprivation.

84. With the implementation of the mitigation measures identified within the separate topics sections listed above (such as measures to minimise construction noise and to minimise the risk of dust generation), potentially adverse impacts are predicted to be of **negligible** or **minor adverse** significance.

Table 34.20 Summary of health effects

Potential effects	Temporal scope	Probability of effect	Sensitivity of		Magnitude of effect	Significance of effect on	
			General population	Vulnerable population		General population	Vulnerable population
Construction							
Noise	Mainly short term	Plausible	Low	High	Low	**Negligible**	**Minor adverse**
Air quality	Mainly short term	Plausible	Low	High	Low	**Negligible**	**Minor adverse**
Ground/water contamination	Short term	Plausible but improbable	Medium	High	Low	**Negligible**	**Negligible**
Physical activity	Very short term	Likely	Medium	High	Low	**Negligible**	**Minor adverse**
Journey times or reduced access	Short term	Likely	Low	High	Low	**Negligible**	**Minor adverse**
Construction and Operation							
Employment	Medium to long term	Likely	Medium	High	Low	**Negligible**	**Minor beneficial**
Operation							
Noise	Long term	Low probability	Low	High	None	**No effect**	**No effect**
EMF and public understanding of risk	Medium term	Low probability	Medium	High	Low	**Negligible**	**Minor adverse**
Electricity affordability	Long term	Likely	Medium	High	Medium	**Minor beneficial**	**Moderate beneficial**
Decommissioning							
The possible health effects arising from the decommissioning of the project are considered to be similar in scale and nature to those considered here for construction.							

34.3.10 Chapter 28 Onshore Archaeology and Cultural Heritage

85. The existing onshore archaeology and cultural heritage baseline has been established by a desk based exercise and supplemented by a programme of aerial photographic surveys and non-intrusive field surveys (such as using ground penetrating radar) to identify potential archaeological features underground.

86. Designated heritage assets (e.g. Scheduled Monuments) have been avoided as part of the site selection process and as such, no direct physical impacts are anticipated to occur. Indirect impacts do, however, have the potential to occur, such as impacts to the setting of a heritage asset.

87. Non-designated heritage assets may be subject to direct and / or indirect impacts as a result of the project. Direct impacts may arise as the result of ground excavation during construction.

88. A draft Written Scheme of Investigation (WSI) (document 8.5) has been submitted with the application. This will inform further decisions regarding the subsequent archaeological mitigation strategy so that the historic environment resource can be safe-guarded in a manner that is both appropriate and proportionate to the significance of the archaeological remains identified and present. With this commitment in place any impacts are considered to be non-significant (**negligible** or **minor adverse**).

Table 34.21 Potential impacts identified for onshore archaeology and cultural heritage

Potential impact	Heritage asset type	Heritage significance (importance)	Magnitude of effect (change)	Impact significance (significance of impact)	Additional mitigation	Residual impact
Construction						
Direct impact on (permanent change to) buried archaeological remains	Buried (sub-surface) archaeological remains	Low to High	Negligible to High (as a WCS)	**Negligible to Major adverse**	Archaeological WSI (onshore) in accordance with the Outline WSI (document 8.5)	**Negligible to Minor adverse**
Direct impact on (permanent change to) above ground archaeological remains e.g. historic earthworks (including the Historic Landscape Character)	Above ground archaeological remains (e.g. extant structures / features, buildings and earthworks)	Low to Medium	Low to Medium	**Minor to Moderate adverse**	Archaeological WSI (onshore) in accordance with the Outline WSI (document 8.5)	**Negligible to Minor adverse**
Indirect impact on the setting of heritage assets (both designated and non-designated)	Designated and certain non-designated heritage assets	Low to High	Negligible	**Negligible to Minor adverse**	Archaeological WSI (onshore) in accordance with the Outline WSI (document 8.5)	**Minor adverse**
Impact on potential geoarchaeological / palaeoenvironmental remains, potentially indicative of former land surfaces	Palaeoenvironmental and geoarchaeological deposits / remains	High (as a WCS)	Negligible	**Negligible to Minor adverse**	Archaeological WSI (onshore) in accordance with the Outline WSI (document 8.5)	**Negligible**
Impacts to site preservation conditions from drilling fluid	Palaeoenvironmental and geoarchaeological	Low to High	Negligible	**Negligible to Minor adverse**	Archaeological WSI (onshore) in accordance with the	**Negligible**

Potential impact	Heritage asset type	Heritage significance (importance)	Magnitude of effect (change)	Impact significance (significance of impact)	Additional mitigation	Residual impact
breakout	deposits / buried archaeological remains				Outline WSI (document 8.5)	
Operation						
Indirect impact on the setting of heritage assets (designated and non-designated)	Designated and certain non-designated heritage assets	High	Negligible	**Minor adverse (as a WCS), but generally No Impact**	None proposed	**Minor adverse (as a WCS), but generally No impact**
Impacts to site preservation conditions from heat loss from installed cables	Palaeoenvironmental and geoarchaeological deposits / buried archaeological remains	Negligible to High	N/A	**No Impact**	N/A	**No impact**
Decommissioning						
Direct impact on (permanent change to) buried archaeological remains	Buried (sub-surface) archaeological remains	Whilst details regarding the decommissioning is currently unknown, considering the WCS for onshore archaeology which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be no worse than those during construction.				
Indirect impact on the setting of heritage assets (designated and non-designated)	Designated and certain non-designated heritage assets	Indirect impacts associated with decommissioning and the setting of heritage assets are not considered likely to be any worse than those identified for the construction and operation and maintenance stages.				

34.3.11 Chapter 29 Landscape and Visual Impact Assessment (LVIA)

89. The potential effects of the onshore components of the project were assessed for landscape and visual receptors during the construction, operation and decommissioning phases of the project. The visibility of the offshore works was scoped out of the assessment owing to its distance offshore and that it will not be visible from the coast.

90. In accordance with relevant guidance, the LVIA methodology aims to determine whether impacts on the landscape as a resource (i.e. landscape elements of the site or the landscape character of the site and surroundings), or on views and visual amenity are significant or non-significant.

91. The LVIA demonstrated that despite the scale of the project, any significant effects would occur in relatively contained areas only, with the majority of landscape and visual receptors either undergoing **non-significant effects** or **no effect**.

92. In respect of the landfall and onshore cable route, **significant** effects would occur only during the construction phase, with no significant effects during the operational phase, as infrastructure will be buried below ground. These effects would be short term in relation to the construction works, and medium term in relation to the re-establishment of hedgerows.

93. During operation, potentially significant visual effects associated with the onshore project substation and National Grid substation extension would be largely contained within the local landscape, owing to the extent of existing woodland cover to the north and east and rising land to the south and, owing to the enclosure of hedgerows along roads and around settlements. As such, **significant** visual effects are limited to road-users on a short section of the A47, an opening on Ivy Todd Road and walkers on Lodge Lane.

94. Mitigation planting will be introduced and has been designed with the aim of reducing these identified impacts. The planting includes areas of fast growing woodland species as this will provide the height required, as well as the density, to ensure effective screening. The commitment to mitigation measures is secured through Requirement [18] of the DCO (Schedule 1 Part 3), including a Landscaping Management Scheme in accordance with the OLEMS (document 8.7) submitted with the DCO application.

Table 34.22 Potential significant effects for landscape and visual receptors

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction - Landfall						
Potential impact on landscape character relating to landfall construction.	Coastal Plain LCT – Bacton to Sea Palling.	Medium to high	Medium to high or medium between the ridge on which Happisburgh Lighthouse sits in the north and PRoW Happisburgh RB22 in the south. Low or no effect across remainder of LCU.	**Significant between the ridge on which Happisburgh Lighthouse sits in the north and PRoW Happisburgh RB22 in the south.** **Not significant across remainder of LCU.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible, relating to construction phase.**
Potential impact on visual amenity of walkers relating to landfall construction.	Walkers on Norfolk Coastal Path	High	Medium to high or medium between Happisburgh coastal car park and PRoW Happisburgh RB22. No effect across remainder of path.	**Significant between Happisburgh coastal car park and PRoW Happisburgh RB22.** **Not significant across remainder of path.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible, relating to construction phase.**
Potential impact on visual amenity of residents relating to landfall construction.	Residents in Happisburgh	Medium to high	Medium on Lighthouse Lane. Low or no effect across remaining parts.	**Significant on Lighthouse Lane.** **Not significant across remaining parts of settlement.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible, relating to construction phase.**
Potential impact on visual amenity of walkers relating to landfall construction.	Walkers on PRoW RB22	Medium to high	Medium to high along length of PRoW.	**Significant along length of PRoW.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible, relating to construction phase.**
Construction - Onshore Cable Route						

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Potential impact on landscape element of hedgerows and hedgetrees relating to onshore cable route construction.	Hedgerows and hedgetrees	Medium	Medium to high or medium in respect of mature good quality hedgerows and hedgetrees. Medium to low in respect of poorer quality hedgerows.	**Significant where mature good quality hedgerows and hedgetrees are removed.** **Not significant for all remaining hedgerows.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 3-5 years to infill gaps. Hedgetrees could not be replanted over cable easements.	**None. Effect short term and reversible in respect of hedgerows and most hedgetrees. Significant where good quality hedgetrees are removed. Long term and reversible effect.**
Potential impact on landscape element of trees relating to onshore cable route construction.	Trees	Medium to high	Medium to high or medium in respect of specific good quality trees. Medium to low in respect of poorer quality or isolated trees.	**Significant where specific good quality trees are removed.** **Not significant for all remaining trees.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 3-5 years to infill gaps. (Trees could not be replanted over cable easements.)	**Significant where good quality trees are removed and cannot be replaced.** **Long term and reversible effect.**
Potential impact on visual amenity of road-users relating to presence of mobilisation area.	Road-users on Dereham Road (west of Scarning)	Medium	Medium over approximate 120m section. Low or no effect across remaining parts.	**Significant over approximate 120m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible.**
Potential impact on visual amenity of road-users relating to trenchless crossing	Road-users on A47 (south-west of Dereham)	Medium	Medium over approximate 150m section. Low or no effect across remaining parts.	**Significant over approximate 150m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible.**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
(e.g. HDD) compounds.						
Potential impact on visual amenity of road-users relating to mobilisation area.	Road-users on B1146 (north of Dereham)	Medium	Medium to high over approximate 800m section. Low or no effect across remaining parts.	**Significant over approximate 800m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 5 - 10 years to infill gaps.	**None. Effect short term and reversible.**
Potential impact on visual amenity of road-users relating to mobilisation area.	Road-users on B1147 (south of Swanton Morley)	Medium	Medium to high over approximate 200m section. Low or no effect across remaining parts.	**Significant over approximate 200m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 5 - 10 years to infill gaps.	**None. Effect short term and reversible.**
Potential impact on visual amenity of road-users relating to mobilisation area and onshore cable route construction.	Road-users on Lime Kiln Road	Medium	Medium over approximate 1.2km and 200m section. Low or no effect across remaining parts.	**Significant over approximate 1.2km and 200m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect short term and reversible.**
Potential impact on visual amenity of road-users relating to mobilisation area.	Road-users on A1067 (west of Sparham)	Medium	Medium over approximate 300m section. Low or no effect across remaining parts.	**Significant over approximate 300m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect short term and reversible.**
Potential impact on visual amenity of road-users relating to onshore cable route construction.	Road-users on B1145 (west of Cawston)	Medium	Medium over approximate 70m section. Low or no effect across remaining parts.	**Significant over approximate 70m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect short term and reversible.**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Potential impact on visual amenity of road-users relating to mobilisation area.	Road-users on Heydon Road	Medium	Medium over approximate 150m section. Low or no effect across remaining parts.	**Significant over approximate 150m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible.**
Potential impact on visual amenity of road-users relating to mobilisation area.	Road-users on A149	Medium	Medium over approximate 400m section. Low or no effect across remaining parts.	**Significant over approximate 400m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction.	**None. Effect short term and reversible.**
Potential impact on visual amenity of road-users relating to onshore cable route construction.	Walkers on Wensum Way	Medium to high	Medium to high over approximate 550m section next to mobilisation area and 80m section at crossing point. Low or no effect across remaining parts.	**Significant over approximate 550m section and 80m section.** **Not significant for remaining parts.**	OLEMS - Land reinstated post construction. Hedgerows replanted post construction – 5-10 years to infill gaps. Trees could not be replanted over cable easements.	**None. Effect short term and reversible.**
Construction – Onshore Project Substation and National Grid substation extension						
Potential impact on landscape element of hedgerows relating to project construction.	Hedgerows	Medium to high	Medium to low	**Not significant**	OLEMS - Advanced planting implemented during construction phase. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect medium term and reversible.**
Potential impact on landscape character relating to project construction.	Plateau Farmland LCT: Pickenham	Medium	High or medium within local area of spur. Low or no effect across	**Significant in local area of spur.** **Not significant across**	OLEMS - Advanced planting implemented during construction phase.	**None. Effect medium term and reversible.**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
	Plateau LCU		remainder of LCU.	**remainder of LCU.**	Hedgerows replanted post construction – 3-5 years to infill gaps.	
Potential impact on landscape character relating to project construction.	Settled Tributary Farmland LCT: River Wissey LCU	Medium	High or medium in the area defined by the A47 to the north, Great Wood and Smuggler's Lane to the east, Necton National Grid Substation and the Necton ridgeline to the west and Ivy Todd Road to the south. Low or no effect across remainder of LCU.	**Significant in the area defined by the A47 to the north, Great Wood and Smuggler's Lane to the east, Necton National Grid Substation and the Necton ridgeline to the west and Ivy Todd Road to the south.** **Not significant across remainder of LCU.**	OLEMS - Advanced planting implemented during construction phase. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect medium term and reversible.**
Potential impact on landscape character relating to project construction.	Plateau Farmland LCT: Beeston Plateau	Medium	High or medium in the area extending to the A47 to the north, Great Wood and Smuggler's Lane to the east, and the LCU boundary to the west and south. Low or no effect across remainder of LCU.	**Significant in the area extending to the A47 to the north, Great Wood and Smuggler's Lane to the east, and the LCU boundary to the west and south.** **Not significant across remainder of LCU.**	OLEMS - Advanced planting implemented during construction phase. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect medium term and reversible.**
Potential impact on visual amenity of road-users relating to project construction.	VP1 Ivy Todd Road (west)	Medium	Medium to high over approximate 10m section. Low or no effect across wider extent of road.	**Significant over approximate 10m section.** **Not significant across wider extent of road.**	OLEMS - Advanced planting implemented during construction phase. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect medium term and reversible.**
Potential impact on	VP2 Lodge	Medium	High over approximate 550m	**Significant over approximate**	OLEMS - Advanced	**None. Effect**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
visual amenity of walkers relating to project construction.	Lane (south)		southern section of lane.	**550m southern section of lane.**	planting implemented during construction phase. Hedgerows replanted post construction – 3-5 years to infill gaps.	**medium term and reversible.**
Potential impact on visual amenity of walkers relating to project construction.	VP3 Lodge Lane (north)	Medium	Medium over approximate 250m northern section of lane.	**Significant over approximate 250m northern section of lane.**	OLEMS - Advanced planting implemented during construction phase. Hedgerows replanted post construction – 3-5 years to infill gaps.	**None. Effect medium term and reversible.**
Potential impact on visual amenity of A47 road-users relating to project construction.	VP4 A47 Necton Substation	Medium	Medium over approximate 250m section of A47. Low or no effect across other adjacent sections.	**Significant over approximate 250m section of A47.** **Not significant across remainder of A47.**	OLEMS - Existing mitigation planting associated with Dudgeon Substation located to south of A47.	**None. Effect medium term and reversible over approximate 300m section.**
Potential impact on visual amenity of A47 road-users relating to project construction.	VP5 A47 Spicer's Corner	Medium	Medium to high over approximate 300m section of A47. Low or no effect across other adjacent sections.	**Significant over approximate 300m section of A47.** **Not significant across remainder of A47.**	OLEMS - Trees replanted post construction – 10 years to infill gaps. Existing mitigation planting associated with Dudgeon Substation located to south of A47.	**None after 10 years. Significant effect long term (10 years) and reversible over approximate 300m section.**
Operation – Onshore Project Substation and National Grid substation extension						
Potential impact on landscape character	Plateau Farmland	Medium	High or medium within local area of spur.	**Significant in local area of spur.**	Landscaping scheme - Mitigation planting	**None after 20 years. Significant**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
relating to project operation.	LCT: Pickenham Plateau LCU		Low or no effect across remainder of LCU.	**Not significant across remainder of LCU.**	would gradually reduce effect to not significant over first 20 years of indicative design life.	**effect long term (20 years) and reversible in localised area.**
Potential impact on landscape character relating to project operation.	Settled Tributary Farmland LCT: River Wissey LCU	Medium	High or medium in the area defined by the A47 to the north, Great Wood and Smuggler's Lane to the east, Necton National Grid Substation and the Necton ridgeline to the west and Ivy Todd Road to the south. Low or no effect across remainder of LCU.	**Significant in the area defined by the A47 to the north, Great Wood and Smuggler's Lane to the east, Necton National Grid Substation and the Necton ridgeline to the west and Ivy Todd Road to the south.** **Not significant across remainder of LCU.**	Landscaping scheme - Mitigation planting would gradually reduce effect to not significant over first 20 years of indicative design life.	**None after 20 years. Significant effect long term (20 years) and reversible in localised area.**
Potential impact on landscape character relating to project operation.	Plateau Farmland LCT: Beeston Plateau	Medium	High or medium in the area extending to the A47 to the north, Great Wood and Smuggler's Lane to the east, and the LCU boundary to the west and south. Low or no effect across remainder of LCU.	**Significant in the area extending to the A47 to the north, Great Wood and Smuggler's Lane to the east, and the LCU boundary to the west and south.** **Not significant across remainder of LCU.**	Landscaping scheme - Mitigation planting would gradually reduce effect to not significant over first 20 years of indicative design life.	**None after 20 years. Significant effect long term (20 years) and reversible in localised area.**
Potential impact on visual amenity of road-users relating to project operation.	VP1 Ivy Todd Road (west)	Medium	High over an approximate 10m section of the road. Low or no effect over wider extent of road.	**Significant over an approximate 10m section of the road.** **Not significant across wider extent of road.**	Landscaping scheme - Mitigation planting would gradually reduce effect to not significant during the first 25 years of indicative design life.	**None after 25 years. Significant effect long term (25 years) and reversible over 10m section.**
Potential impact on	VP2 Lodge	Medium	High along approximate	**Significant along**	Landscaping scheme -	**None after 20**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
visual amenity of walkers relating to project operation.	Lane (south)		550m southern section. Low or no effect over remaining parts of lane.	**approximate 550m southern section.**	Mitigation planting would gradually reduce effect to not significant over first 20 years of indicative design life.	**years. Significant effect long term (20 years) and reversible over 550m section. Beneficial effect for remaining 10 years.**
Potential impact on visual amenity of walkers relating to project operation.	VP3 Lodge Lane (south)	Medium	Medium along approximate 250m southern section. Low or no effect over remaining parts of lane.	**Significant along approximate 250m southern section.**	Landscaping scheme - Mitigation planting would gradually reduce effect to not significant after 20 years.	**None after 20 years. Significant effect long term (20 years) and reversible over 250m section. Beneficial effect for remaining 10 years.**
Potential impact on visual amenity of A47 road-users relating to project operation.	VP5 A47 Spicer's Corner	Medium	Medium to high over approximate 50m section of A47 reducing to low as mitigation planting matures. Low or no effect across other adjacent sections.	**Significant over approximate 50m section of A47 reducing to not significant as mitigation planting matures.** **Not significant across adjacent sections.**	Landscaping scheme - Mitigation planting would gradually reduce effect to not significant after 10 years Existing mitigation planting associated with Dudgeon Substation located to south of A47.	**None after 10 years. Significant effect long term (10 years) and reversible over 50m section. Beneficial effect for remaining 20 years.**
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, impacts during the decommissioning stage are assumed to be no worse than those identified during the						

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
construction stage.						

34.3.12 Chapter 30 Tourism and Recreation

95. A desk-based assessment, combined with consultation, was undertaken to enable identification of the important recreational and tourism features within the study area.

96. There is the potential for tourism and recreation impacts to occur in the short term to local features near the landfall works (i.e. coastal areas and footpaths) during construction due to noise, traffic and general construction presence. Provided mitigation measures are in place the project is predicted to have no greater than **minor impacts**. In addition, at the landfall, ducts will be drilled under the cliffs and beach, which will avoid the need for any construction works on the beach. No impacts were identified to tourism and recreation receptors during operation.

Table 34.23 Potential Impacts Identified for tourism and recreation

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction						
Impact 1: Increased marine construction traffic affecting attractiveness of the coastline for Tourism and recreation.	Tourists	Low	Negligible	**Negligible**	None	**Negligible**
Impact 2: Disruption of marine recreational activities including sailing and other water sports	Recreational marine users	Low	Low	**Negligible**	None	**Negligible**
Impact 3: Deterioration to Bathing Water / Blue Flag beaches and resulting effect on Tourism and Recreation	Blue Flag beaches and associated local businesses	Medium	Negligible	**Minor adverse**	None	**Minor adverse**
Impact 4: Disruption to onshore coastal recreational and tourism assets	Tourism and recreation assets	Medium	Minor	**Minor adverse**	OLEMS CoCP TMP	**Negligible**
Impact 5: Visual impacts of construction activity	Tourists and local communities using the area recreationally	Low	Low	**Minor adverse**	OLEMS CoCP	**Minor adverse**
Impact 6: Reduction of tourist accommodation availability due to non-resident work force	Hotels and other accommodation	Low	Negligible	**Negligible**	None	**Negligible**
Impact 7: Obstruction or disturbance to inland tourism and recreation assets	Tourism and recreation assets	Medium	Low	**Minor adverse**	CoCP	**Minor adverse**

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Impact 8: Obstruction or disturbance to users of paths or non-motorised routes	Tourists and local communities using the area recreationally	Medium to high	Low	**Moderate to major adverse**	CoCP	**Negligible to minor adverse**
Impact 9: Traffic increase	Pedestrian amenity	Low to High (see Chapter 24)	Medium to High	**Moderate to major adverse**	TMP CoCP	**Minor adverse**
Impact 10: Disruption or impacts to open access or public land	Open or public land areas	None interacted with	No Impact	**No impact**	N/A	**No Impact**
Operation						
Impact 1: obstruction of disturbance to marine recreation	Recreational marine users	Negligible	Negligible	**Negligible**	None proposed	**Negligible**
Impact 2: Visual and noise impacts on land-based tourism and recreation assets	Tourists	Low	Negligible	**Negligible**	None proposed	**Negligible**
Impact 3: Permanent closure of paths or non-motorised routes	Recreational users	Negligible	No Impact	**No impact**	N/A	**No impact**
Impact 4: Reduction in visitor numbers due to tourist perceptions of wind farms	Potential visitors to Norfolk	Low	No Impact	**No impact**	N/A	**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.						

34.3.13 Chapter 31 Socio-Economics

97. A review of policy, strategy, and business analysis was undertaken that showed that the offshore wind industry in East Anglia is growing quickly, with Vattenfall seen as a significant contributor in this growth. The project may create up to 1,063 full time equivalent (FTE) jobs during construction and up to 294 FTE jobs during operation. The East Anglia job market may be able to supply this demand and this would represent a potential minor benefit.

98. When considered cumulatively with other projects, there is the potential for major long term benefits to the region due to increased employment across the supply chain serving the offshore wind industry.

Table 34.24 Potential beneficial impacts identified for socio-economics

Potential Impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Construction						
Direct and Indirect job creation	Regional labour market	Medium	Medium	**Moderate beneficial**	Enable local supply-chain	**Moderate beneficial**
Supply chain job creation	Businesses in regional supply chain	Medium	Medium	**Moderate beneficial**	Enable local supply-chain	**Major beneficial**
Operation						
Direct employment and supply chain job creation	Regional labour market	Medium	Negligible	**Minor beneficial**	Local supply chain plan and investment in local human resources	**Minor beneficial**
Decommissioning – expected to be similar to construction or lower						
Onshore Direct Employment and Supply Chain Job Creation	Regional labour market	Low	Low	**Minor beneficial**	Enable local supply-chain	**Negligible**
Cumulative						
Job creation during construction	Regional labour market	Low	Medium	**Minor beneficial**	Engagement with sector bodies	**Moderate beneficial**
Supply chain job creation during operation	Regional labour market	Medium	Medium	**Moderate beneficial**	Engagement with sector bodies	**Major beneficial**

Table 34.25 Potential adverse impacts identified for socio-economics

Potential Impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Construction						
Effects on community infrastructure	Community infrastructure assets	Low	Low	**Minor adverse**	Noise and visual management described in other chapters	**Minor adverse**
Operation						
Effects on community infrastructure	Community infrastructure assets	Low	Negligible	**Negligible**	Visual impacts outline in Chapter 29 Landscape and Visual Impact Assessment	**Negligible**
Decommissioning – expected to be similar to construction or lower						
Effects on community infrastructure	Community infrastructure assets	Low	Low	**Minor adverse**	Noise and visual management described in other chapters	**Minor adverse**

34.4 Conclusions

99. For all offshore topics, the assessments conclude that the project will not result in significant impacts once appropriate mitigation has been implemented. Consultation to agree mitigation and monitoring will be ongoing throughout the development of the final design of the project to allow the best available information to be implemented.

100. For onshore topics the assessments conclude that the proposed Norfolk Vanguard project will not result in significant impacts once appropriate mitigation has been implemented, with a small number of exceptions. It should be noted that identified significant residual impacts are predominantly localised, temporary effects, which are reversible after the completion of construction. Or which will reduce to non-significant over time, for example as vegetation establishes.

101. Moderate adverse impacts have been identified during construction in Chapter 20 Water Resources and Flood Risk, on the River Bure, King's Beck, Blackwater Drain and Wendling Beck sub-catchments, due to their value and sensitivity. The assessment is based on the cumulative effect of multiple watercourse crossings within each sub-catchment, rather than the impacts associated with any single crossing. Furthermore, this assessment is based on the worst case assumption that it will be necessary to install permanent culverts. However, every effort will be made to avoid the use of permanent culverts; any effects as a result of temporary crossings will be temporary and reversible and, with the implementation of mitigation, would not result in significant residual impacts.

102. Potential significant impacts on bats and great crested newts have been identified in Chapter 21 Onshore Ecology, due to the precautionary approach applied for areas of unsurveyed land. Pre-construction ecological surveys will be undertaken and, where the presence of these species is confirmed, appropriate mitigation measures would be developed, adhering to Natural England Standing Advice, to avoid significant impacts.

103. Impacts on hedgerows have also been identified as potentially significant, due to the duration of the temporary impacts during construction. However, these impacts will reduce over time, becoming non-significant, as replacement hedgerows establish.

104. Potentially significant impacts were also identified on one road within Chapter 24 Traffic and Transport. This is related to severance and pedestrian amenity along a single road during construction. The impact is very localised and is for a relative short duration. A Traffic Management Plan will be developed and agreed with the relevant Highways Authorities with measures for managing the HGV movements on this sensitive highway link implemented.

105. Some potentially significant impacts have been identified in Chapter 29 Landscape and Visual Impact Assessment, within localised extents of certain components of the project. The LVIA and CIA have demonstrated that despite the scale of the project, the significant effects would occur in relatively contained parts of each relevant study area, with the majority of landscape and visual receptors in each study area either undergoing not significant effects or no effect.

106. Sensitive site selection alongside embedded and additional topic specific mitigation, as appropriate, will deliver a project that avoids the vast majority of the potential impacts assessed entirely. Potential adverse impacts identified through the worst case assessment are of (minor to moderate) adverse significance and are typically temporally and geographically limited.

107. Positive impacts resulting from the project e.g. direct employment and supply chain job creation are long term, and aligned with the Government's Clean Growth Strategy to help to boost productivity, and grow and decarbonise the economy of Norfolk, the East of England and the UK as a whole. Norfolk Vanguard alone could meet the equivalent of 5% of the UK's domestic electricity needs or more than 25% of the commercial, industrial and domestic electricity demand of the East of England.