Norfolk Boreas Offshore Wind Farm

Chapter 26

Air Quality

Environmental Statement

Volume 1

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Glossary of Acronyms

AADT	Annual Average Daily Traffic
APIS	Air Pollution Information System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ADMS	Atmospheric Dispersion Modelling System
CEH	Centre for Ecology and Hydrology
CoCP	Code of Construction Practice
CL	Critical Load
CIA	Cumulative Impact Assessment
DECC	Department of Energy and Climate Change
Defra	Department of Environment Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DMRB	Design Manual for Roads and Bridges
DCO	Development Consent Order
EIA	Environmental Impact Assessment
EPUK	Environmental Protection United Kingdom
EU	European Union
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
HDD	Horizontal Directional Drill
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
HMSO	Her Majesty's Stationary Office
IAQM	Institute of Air Quality Management
km	Kilometre
km/h	Kilometres per hour
LDV	Light Duty Vehicle
LAQM	Local Air Quality Management
m	Metre
µg.m-3	Micrograms (of pollutant) per cubic meter (of air)
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
N	Nitrogen
NO_2	Nitrogen Dioxide
NRMM	Non-Road Mobile Machinery
NOx	Oxides of Nitrogen
PM_{10}	Particulate Matter with an aerodynamic diameter of less than 10µm
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter of less than 2.5µm
PEIR	Preliminary Environmental Information Report
SoS	Secretary of State
SSSI	Site of Special Scientific Interest
SAC	Special Areas of Conservation
SPA	Special Protection Areas

TG	Technical Guidance
UK	United Kingdom
WCS	Worst Case Scenario

Glossary of Terminology

Air pollutants	Amounts of foreign and/or natural substances occurring in the atmosphere that may result in adverse effects on humans, animals, vegetation and/or materials.
Air Quality Objectives	A series of objectives set by the UK Government's Expert Panel on Air Quality to be achieved either without exception or with a permitted number of exceedances within a specific timescale.
Ambient air quality	The concentrations of gases and particles in the atmosphere (tropospheric boundary layer) to which the general population are currently exposed, as opposed to the concentration of pollutants emitted by a specific source.
Annual average daily traffic	A daily traffic flow (24hrs), expressed as a mean daily flow across all 365 days of the year (AADT) in units of vehicles per hour.
Annual mean concentration	The average (mean) of the hourly pollutant concentrations measured or predicted for a one year period.
Cable pulling	Installation of cables within pre-installed ducts from jointing pits located along the onshore cable route.
Ducts	A duct is a length of underground piping, which is used to house electrical and communication cables.
Dust	A generic term that BS6069 (Part 2) used to describe particulate matter in the size range 1 – 75 µm (micrometres) in diameter.
Ecological receptors	Area where the ecology is considered valuable and has one or more designations such as SSSI, SPA, SAC, RAMSAR, LNR or Ancient Woodlands.
Emission factors	The average emission rate of a given pollutant for a given source, relative to units of activity. Used to model future pollution concentrations under different scenarios.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach to the EIA and information to support the HRA.
Heavy Duty Vehicle	A vehicle type classification, including rigid and articulated heavy goods vehicles, plus buses and coaches, that is used by air quality dispersion models.
Human receptors	Areas where the occupants are more susceptible to the adverse effects of pollutants.
Jointing pit	Underground structures constructed at regular intervals along the onshore 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.
Light Duty Vehicle	A vehicle type classification including motorcycles, cars and light goods vehicles, that is used by air quality dispersion models.
Mobilisation area	Areas approx. 100 x 100m used as access points to the running track for duct installation. Required to store equipment and provide welfare facilities. Located adjacent to the onshore cable route, accessible from local highways network suitable for the delivery of heavy and oversized materials and equipment.
National Grid substation extension	The permanent footprint of the National Grid substation extension.

Necton National Grid substation	The grid connection location for Norfolk Boreas and Norfolk Vanguard.
Onshore cable route	The up to 35m working width within a 45m wide corridor 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	The area of the onshore infrastructure (landfall, onshore cable route, accesses, trenchless crossing zones and mobilisation areas; onshore project substation and extension to the Necton National Grid substation and overhead line modifications).
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.
Particulate matter	Solid particles or liquid droplets suspended or carried in the air.
Running track	The track along the onshore cable route which the construction traffic would use to access workfronts.
The Applicant	Norfolk Boreas Limited.
The project	Norfolk Boreas Wind Farm including the onshore and offshore infrastructure.
Trackout	The transport of mud and other dusty materials from a works area onto the public highway. Usually on the wheels and body work of vehicles.
Trenchless crossing zone (e.g. HDD)	Areas within the onshore cable route which will house trenchless crossing entry and exit points.
Workfront	A length of onshore cable route within which duct installation works will occur, approximately 150m.

26 AIR QUALITY

26.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the potential impacts of the onshore project area for the proposed Norfolk Boreas project (herein 'the project') on air quality.

2. This chapter provides an overview of the existing baseline environment in respect to air quality within the defined air quality study area (see section 26.5.1) around the onshore project area. The baseline environment has then been used to inform an assessment of the potential impacts and associated mitigation for the construction, operation and decommissioning of the project on air quality.

3. Vattenfall Wind Power Limited (VWPL) (the parent company of Norfolk Boreas Limited) is also developing Norfolk Vanguard, a 'sister project' to Norfolk Boreas. In order to minimise impacts associated with onshore construction works for the two projects, Norfolk Vanguard are seeking to obtain consent to undertake enabling works for both projects at the same time. However, Norfolk Boreas needs to consider the possibility that Norfolk Vanguard may not proceed to construction.

4. The Environmental Impact Assessment (EIA) has therefore been undertaken using the following two alternative scenarios (further details are presented in Chapter 5 Project Description) and an assessment of potential impacts has been undertaken for each scenario:

   - **Scenario 1** – Norfolk Vanguard proceeds to construction and installs ducts and other shared enabling works for Norfolk Boreas.
   - **Scenario 2** – Norfolk Vanguard does not proceed to construction and Norfolk Boreas proceeds alone. Norfolk Boreas undertakes all works required as an independent project.

5. The assessment also considers cumulative impacts of existing and proposed projects with Norfolk Boreas. The proposed methodology for the EIA and Cumulative Impact Assessment (CIA) is discussed in section 26.8.

6. Due to the close association between air quality and a number of other topics, this chapter refers to other onshore chapters where appropriate. The relevant chapters are:

   - Chapter 22 Onshore Ecology;
   - Chapter 24 Traffic and Transport; and
   - Chapter 27 Human Health.

7. Onshore operational phase impacts were scoped out of the assessment, as this would have been limited to operational phase traffic movements, which are anticipated to be negligible. As a result, operational phase impacts are not considered further within this assessment. This approach was agreed with the Secretary of State (SoS) in the Scoping Opinion (Planning Inspectorate, 2017).

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

9. The terminology and impact assessment methodologies used in this chapter differ from the generic impact assessment terminology presented within Chapter 6 EIA Methodology, as air quality guidance documents include specific assessment criteria. The assessment methodology used for the EIA and CIA are detailed in sections 26.4 and 26.8.

26.2 Legislation, Guidance and Policy

26.2.1 Legislation

10. There are a number of pieces of legislation applicable to air quality. The following sections provide detail on key pieces of international and United Kingdom (UK) legislation which are relevant to this chapter.

26.2.1.1 European Union directives

11. Air pollution can have adverse effects on the health of humans and ecosystems. European Union (EU) legislation forms the basis for UK air quality policy. The EU Air Quality Framework Directive 96/62/EC on Ambient Air Quality Assessment and Management entered into force in 1996 (European Parliament, 1996). Directive 96/62/EC and the first three Daughter Directives were combined to form the new EU Directive 2008/50/EC (European Parliament, 2008) on Ambient Air Quality and Cleaner Air for Europe, which came into force in June 2008.

26.2.1.2 United Kingdom Air Quality Strategy

12. The 1995 Environment Act required the preparation of a national Air Quality Strategy (AQS) which sets air quality standards for specified pollutants. The Act also outlined measures to be taken by local authorities in relation to meeting these standards and objectives, which became the Local Air Quality Management (LAQM) system.

13. The UK AQS was originally adopted in 1997 (Department of the Environment (DoE), 1997) and has been reviewed and updated to take account of the evolving EU legislation, technical and policy developments and the latest information on health effects of air pollution. The strategy was revised and reissued in 2000 as the AQS for England, Scotland, Wales and Northern Ireland (Department of the Environment,

Transport and the Regions (DETR), 2000). This was subsequently amended in 2003 (DETR, 2003) and was last updated in July 2007 (Defra, 2007).

26.2.1.3 Local air quality management

14. The standards and objectives relevant to the LAQM framework have been prescribed through the Air Quality (England) Regulations (2000) (Her Majesty's Stationary Office (HMSO), 2000), and the Air Quality (England) (Amendment) Regulations (2002) (HMSO, 2002). The EU Limit Values have been implemented via the Air Quality Standards Regulations (2010), which set out the combined Daughter Directive limit values and interim targets for Member State compliance (HMSO, 2010).

15. The current air quality standards and objectives of relevance to this assessment are presented in Table 26.1. Pollutant standards relate to ambient pollutant concentrations in air, set on the basis of medical and scientific evidence of how each pollutant affects human health. Pollutant objectives, however, incorporate target dates and averaging periods which take into account economic considerations, practicability and technical feasibility.

16. Where an air quality objective is unlikely to be met by the relevant deadline, local authorities must designate those areas as Air Quality Management Areas (AQMAs) and take action to work towards meeting the objectives. Following the designation of an AQMA, local authorities are required to develop an Air Quality Action Plan (AQAP) to work towards meeting the objectives and to improve air quality locally.

17. Possible exceedances of Air Quality Objectives are usually assessed in relation to those locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective.

Table 26.1 Air quality strategy objectives (England) for the purposes of LAQM

Pollutant	Air Quality Objectives		To be achieved by
	Concentration	Measured as*	
Nitrogen Dioxide (NO_2)	200 µg.m^{-3}	1 hour mean not to be exceeded more than 18 times per year	31/12/2005
	40 µg.m^{-3}	Annual mean	31/12/2005
Particles (Particulate Matter with an aerodynamic diameter of less than 10µm - PM_{10})	50 µg.m^{-3}	24-hour mean not to be exceeded more than 35 times per year	31/12/2004
	40 µg.m^{-3}	Annual mean	31/12/2004
Particles (Particulate Matter with an aerodynamic diameter of less than 2.5µm $PM_{2.5}$)	25 µg.m^{-3}	Annual mean (target)	2020
	15% cut in annual mean (urban background exposure)	Annual mean	2010 - 2020

*The way the objectives are to be measured is set out in the UK Air Quality (England) Regulations

26.2.2 National Policy

26.2.2.1 National Policy Statements

18. The assessment of potential impacts upon air quality receptors has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIP). Those relevant to the project are:

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

19. The specific assessment requirements for air quality, as detailed in the NPS, are summarised in Table 26.2 together with an indication of the section of this chapter where each is addressed. Where any part of the NPS has not been followed within the assessment an explanation as to why the requirement was not deemed relevant, or has been met in another manner, is provided.

20. EN-3 and EN-5 do not specifically include details on the assessment of air quality.

Table 26.2 NPS assessment requirements

NPS requirements	NPS reference	ES reference
Any Environmental Statement (ES) on air emissions will include an assessment of CO_2 emissions, but the policies set out in Section 2 [of EN-1], including the EU ETS, apply to these emissions. The IPC (now Planning Inspectorate) does not, therefore need to assess individual applications in terms of carbon emissions against carbon budgets.	EN-1 paragraph 5.2.2	Not applicable to assessment.
The ES should describe: • Any significant air emissions, their mitigation and any residual effects distinguishing between the project stages and taking account of any significant emissions from any road traffic generated by the project; • The predicted absolute emission levels of the proposed project, after mitigation methods have been applied; • Existing air quality levels and the relative change in air quality from existing levels; and • Any potential eutrophication impacts.	EN-1 paragraph 5.2.7	These points are considered within section 26.6.6 It is not anticipated that there would be any significant eutrophication impacts, as the assessment of nutrient nitrogen deposition concluded that development-generated impacts would not be significant

26.2.3 Local Planning Policy

21. EN-1, paragraph 4.1.5, states that:

"Other matters that the IPC may consider important and relevant to its decision-making may include Development Plan Documents or other documents in the Local Development Framework. In the event of a conflict between these or any other documents and an NPS, the NPS prevails for the purposes of IPC decision making given the national significance of the infrastructure."

22. The project landfall, onshore cable route, onshore project substation and National Grid extension works including overhead line modifications fall within the following Local Authorities' areas of jurisdiction:

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

23. The onshore project area also falls wholly within the jurisdiction of Norfolk County Council.

24. Additionally, construction vehicle access routes as identified in Chapter 24 Traffic and Transport, would pass through the following Local Authority boundaries:

- King's Lynn and West Norfolk District Council;
- Great Yarmouth Borough Council;
- Waveney District Council; and
- South Norfolk District Council.

25. The current planning policy documents and policies relevant to air quality are detailed in Table 26.3.

Table 26.3 Relevant local planning policies

Document	Policy/Guidance	Policy/Guidance Purpose
North Norfolk District Council Core Strategy (2008)	Policy EN13 Pollution and Hazard Prevention and Minimisation: "Proposals will only be permitted where, individually or cumulatively, there are no unacceptable impacts on air quality."	Protect human health
Broadland District Council Local Plan (2014)	Policy EN 4 Pollution: "Where a proposed development would result in airborne pollutants exceeding statutory objectives, it will not be permitted unless appropriate mitigation measures are agreed. Development which may give rise to airborne emissions of potentially harmful substances, including smoke, grit and dust, will be required to provide a risk assessment of the likelihood of demonstrable harm to human health or to the environment. Particular account will be taken of any sensitive uses, which would adjoin or otherwise be affected by such emissions."	Protect human health and prevent nuisance
Breckland Council Core Strategy and Development Control Policies Development Plan (2009)	Policy CP8 Natural Resources: "Development should minimise any unavoidable adverse effects on air quality. These objectives will be achieved through the phasing of development allocations in subsequent Development Plan Documents and the development control process. Direct contamination caused by the construction process or resultant operations should be avoided."	Protect human health and prevent nuisance
King's Lynn and West Norfolk District Council Local Plan (2016)	Policy DM15-Environment, Design and Amenity Development must protect and enhance the amenity of the wider environment including its heritage and cultural value. Proposals will be assessed against their impact on neighbouring uses and their occupants as well as the amenity of any future occupiers of the proposed development. Proposals will be assessed against a number of factors including: Air quality." Policy DM20-Renewable Energy "Proposals for renewable energy (other than proposals for wind energy development) and associated infrastructure, including the landward infrastructure for offshore renewable schemes, will be assessed to determine whether or not the benefits they bring in terms of the energy generated are outweighed by the impacts, either individually or cumulatively, upon: Amenity (in terms of noise, overbearing relationship, air quality and light pollution)."	Protect human health and prevent nuisance

Document	Policy/Guidance	Policy/Guidance Purpose
Great Yarmouth Borough Council Local Plan Core Strategy (2015)	Policy CS9-Encourage well-designed, distinctive places. "Seek to protect the amenity of existing and future residents, or people working in, or nearby, a proposed development, from factors such as noise, light and air pollution and ensure that new development does not unduly impact upon public safety." Policy CS11-Enhancing the natural environment "Ensuring that all new development takes measures to avoid or reduce adverse impacts on existing biodiversity and geodiversity assets. Where adverse impacts are unavoidable, suitable measures will be required to mitigate any adverse impacts. Where mitigation is not possible, the Council will require that full compensatory provision be made."	Protect human health and prevent nuisance Protect designated ecological sites
South Norfolk District Council Local Plan (2015)	Policy DM3.14 Pollution, health and safety "All development should minimise and where possible reduce the adverse impact of all forms of emissions and other forms of pollution, and ensure that there is no deterioration in water quality or water courses. b) When assessed individually or cumulatively, development proposals should ensure that there will be no unacceptable impacts on air quality. Developments which may impact on air quality will not be permitted where they have an unacceptable impact on human health, sensitive designated species or habitats, and general amenity, unless adequate mitigation can be ensured. Development will not be granted in locations where it is likely to result in an Air Quality Management Area being designated or the worsening of air quality in an existing Air Quality Management Area."	Protect human health and prevent nuisance
Waveney District Council Core Strategy (2009)	"1.31 The Local Transport Plan objectives that will assist in implementing these longer-term objectives in Waveney are: Minimise the impact of traffic and transport infrastructure (including air quality) in market towns, villages, tourism honey pots and rural areas to protect the county's environment and built heritage."	Protect human health and prevent nuisance

26.3 Consultation

26. Consultation is a key driver of the EIA process and is an ongoing process throughout the lifecycle of the project, from the initial stages through to consent and post-consent. To date, consultation regarding air quality has been conducted through the Scoping Report (Royal HaskoningDHV, 2017), the Evidence Plan Process (EPP), namely the Air Quality Method Statement (Royal HaskoningDHV, 2018, unpublished) and the Preliminary Environmental Information Report (PEIR) (Norfolk Boreas

Limited, 2018). Feedback received during the process to date has been incorporated into this ES.

27. As the majority of the onshore infrastructure for Norfolk Boreas and Norfolk Vanguard is co-located, the pre-application consultation undertaken for Norfolk Vanguard is relevant to both projects and has been used to inform the approach to this assessment. In addition, where possible any comment received as part of the Norfolk Vanguard examination process, up to Deadline 5 (20th March 2019) have also be considered.

28. A Scoping Opinion for Norfolk Boreas was sought from the Planning Inspectorate as part of the EIA process in May 2017. The scoping phase concluded that, in terms of onshore impacts, the operation of the project would not result in any significant change in vehicle flows to and from the site or introduce new emission sources. The SoS noted that numbers of vehicle movements were not included in the Scoping Report (Royal HaskoningDHV, 2017), however, it was accepted that the conclusion in respect of potential air quality effects was valid given the nature of the project. The SoS therefore agreed that onshore operational phase air quality impacts could be scoped out from further consideration (Planning Inspectorate, 2017).

29. With regard to offshore impacts, it was concluded that the number of construction vessel movements and associated atmospheric emissions would be extremely small in comparison to the total shipping in the southern North Sea. The Planning Inspectorate therefore agreed that offshore air quality impacts were not considered to be significant and could be scoped out (Planning Inspectorate, 2017).

30. A summary of the consultation that has been undertaken and information from Norfolk Vanguard which has been used to inform the development of this air quality assessment is provided in Table 26.4.

Table 26.4 Consultation Responses

Consultee	Date /Document	Comment	Response / where addressed in the ES
SoS	June 2017, Norfolk Boreas Scoping Opinion	The SoS recommends that the methodology and choice of air quality receptors are agreed with the relevant Environmental Health Officers of the local authorities and the EA as appropriate.	Section 26.6.4 details the methodology followed for the identification of human and ecological receptors based on the study area as agreed with the Environmental Health Officer and Environment Agency.

Consultee	Date /Document	Comment	Response / where addressed in the ES
		As no site specific air quality monitoring surveys are proposed (paragraph 967 of the Scoping Report), the Applicant should justify their position that existing air quality monitoring data coverage is appropriate having undertaken the desk based review and therefore that additional baseline surveys are not required.	The existing air quality monitoring data coverage is considered to be appropriate. This is presented in section 26.5.2.
		The SoS considers that given the nature of the development, this conclusion is likely and therefore agrees that onshore operational air quality can be scoped out of the assessment.	Operational air quality has not been considered in the ES.
		The SoS welcomes the provision of an Air Quality Management Plan to be developed as part of the CoCP and recommends that a draft version is provided with the DCO application.	A draft Air Quality Management Plan is included as part of the outline Code of Construction Practice (CoCP) submitted as part of the Development Consent Order (DCO) application.
		The ES should clearly set out the methodology for assessing the potential impacts of dust and road traffic emissions. In particular, paragraphs 940 – 942 of the Scoping Report set out the criteria for identifying sensitive receptors to construction air quality impacts and these should be set out in the context of relevant guidance such as that of the Institute of Air Quality Management (IAQM) as referenced in section 3.3.4 of the Scoping Report.	Methodology is detailed in section 26.4
Breckland Council	December 2017 Norfolk Vanguard PEIR response	Breckland Council Has Declared an AQMA in Swaffham town centre. Although there is no indication on the transport maps that any traffic be routed through Swaffham town, I would ask that any traffic arising because of the construction or operation of the development is not routed through Swaffham town centre.	Confirmed during telephone call with Breckland Council as part of the Norfolk Vanguard consultation process. Traffic will not be routed through the Swaffham AQMA.
Expert Topic Group (ETG) (Norfolk County Council, Breckland Council, Broadland District Council, North Norfolk District Council)	January 2018 Norfolk Boreas Air Quality Method Statement	No comments on the proposed methodology received.	No action required

Consultee	Date /Document	Comment	Response / where addressed in the ES
Broadland District Council	September 2018 Relevant Representation for Norfolk Vanguard	A separate cable corridor and associated development within the District is proposed as part of the Hornsea Three off-shore windfarm. The cumulative impacts of the two proposals need to be considered. In this respect it is noted that Hornsea Three are proposing their main construction compound on part of the former airfield to the east of Oulton, in addition to the two construction compounds that Vattenfall are proposing in Oulton using the same access road as the Hornsea Three proposals.	Cumulative air quality impacts with the Hornsea Project Three project are considered in section 26.8
ETG	December 2018 Norfolk Boreas PEIR	No comments received.	No action required

31. Following the Norfolk Boreas PEIR consultation period, in February 2019 the ETG were notified (by email) of an update to the approach of verification following availability of updated monitoring data. Details of the verification process are in section 26.4.1.2.7.

26.4 Assessment Methodology

26.4.1 Impact Assessment Methodology

26.4.1.1 Construction phase dust and fine particulate matter

32. Assessment of potential impacts associated with construction phase dust and fine particulate matter emissions was undertaken in accordance with the latest Institute of Air Quality Management (IAQM) guidance (IAQM, 2014). The terminology differs from the generic impact assessment terminology presented within Chapter 6 EIA Methodology.

33. A summary of the assessment process is provided below:

26.4.1.1.1 Construction phase assessment steps:

1) Screen the need for a more detailed assessment;

2) Assessment conducted separately for demolition, earthworks, construction and trackout[1]:

   a) Determine potential dust emission magnitude;

   b) Determine sensitivity of the area; and

[1] Trackout is defined as the transport of dust and dirt from the construction site onto the public road network.

c) Establish the risk of dust impacts.

3) Determine site specific mitigation; and

4) Examine the residual effects to determine if additional mitigation is required.

34. Full details of the assessment methodology are provided in Appendix 26.1.

26.4.1.1.2 Sensitivity

35. Definitions of the different sensitivity levels for human and ecological receptors to dust are given in Table 26.5. Sensitivity levels are taken from IAQM guidance (IAQM, 2014).

Table 26.5 Definitions of the different sensitivity levels for receptors to construction dust

Sensitivity	Sensitivity of people and property to dust soiling	Sensitivity of people to the health effects of PM_{10}	Sensitivity of ecological receptors
High	Dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms.	Residential properties, hospitals, schools and residential care homes.	International or national designation and features affected by dust soiling or locations with dust-sensitive species.
Medium	Parks, places of work.	Office and shop workers not occupationally exposed to PM_{10}.	Locations with important plant species or national designation with features affected by dust soiling.
Low	Playing fields, farmland, footpaths, short-term car parks and roads.	Public footpaths, playing fields, parks and shopping streets.	Local designation where features may be affected by dust deposition.

26.4.1.1.3 Magnitude

36. The magnitude of construction phase dust emissions should be defined for each type of activity. These are broken down into four categories: demolition, earthworks, construction and trackout. The dust emission magnitudes can either be small, medium or large and are dependent on the methods of work undertaken and the scale of the activity. It is anticipated that there will be no dust-generating demolition required as part of the construction phase of the project; therefore, this was not considered as part of the assessment.

37. The dust emission magnitudes for each activity are detailed in Table 26.6.

Table 26.6 Definitions of the different magnitudes of construction phase dust emission

Activity	Criteria used to Determine Dust Emission Magnitude		
	Small	Medium	Large
Earthworks	Total site area <2,500m^2.	Total site area 2,500 – 10,000m^2.	Total site area >10,000m^2.
Construction	Total building volume <25,000m^3.	Total building volume 25,000 – 100,000m^3.	Total building volume >100,000m^3.

Activity	Criteria used to Determine Dust Emission Magnitude		
	Small	Medium	Large
Trackout	<10 outward Heavy Goods Vehicle (HGV) trips in any one day. Unpaved road length <50m.	10-50 outward HGV trips in any one day. Unpaved road length 50-100m.	>50 outward HGV trips in any one day. Unpaved road length >100m.

38. As detailed in Table 26.6, the IAQM guidance provides broad ranges of the area of a site, the total building volume and the number of outward vehicle trips which are used to determine the dust emission magnitude.

26.4.1.1.4 Significance

39. The dust emission magnitude should be combined with the sensitivity of the area to determine the risk of impacts prior to mitigation. This is shown in more detail in Appendix 26.1. Once appropriate mitigation measures have been identified as required, the significance of construction phase impacts can be determined. The aim is to prevent significant effects at receptors due to the implementation of effective mitigation. A matrix is therefore not provided in the guidance to determine significance.

26.4.1.2 Construction vehicle exhaust emissions

26.4.1.2.1 Screening criteria and assessed road links

40. The requirement for a detailed assessment of construction vehicle exhaust emissions at human and ecological receptors has been considered using screening criteria provided by the IAQM and Environmental Protection UK (EPUK) (IAQM and EPUK, 2017), and the Design Manual for Roads and Bridges (DMRB) (Highways Agency, 2007). Only the DMRB guidance contains criteria relating to assessment of designated ecological sites.

41. The assessment criteria are detailed in Table 26.7.

Table 26.7 IAQM and EPUK and DMRB road traffic assessment screening criteria

Guidance document		Screening criteria
IAQM and EPUK	Light Duty Vehicles (LDVs)	A change in annual average daily traffic (AADT) of more than 100 within or adjacent to an AQMA, or more than 500 elsewhere
	Heavy Duty Vehicles (HDVs)	An increase in HGV movements of more than 25 per day within or adjacent to an AQMA, or more than 100 elsewhere
DMRB	LDVs	Increase of 1,000 AADT or more
	HDVs	An increase in HGV movements of more than 200 per day

42. The increases in traffic flows on the road network associated with the construction phase of the project were screened using the criteria detailed in Table 26.7 and was undertaken separately for Scenario 1 and Scenario 2. Road links which are anticipated to experience increases in traffic flows greater than the screening criteria were considered in the assessment. As such, sensitive receptor locations were identified on the affected road links only. Road links which were predicted to experience increases in vehicle numbers and HGVs in exceedance of the criteria are detailed in Table 26.8 and Figure 26.1 for Scenario 2, and Table 26.9 and Figure 26.3 for Scenario 1.

43. Construction activities associated with Scenario 2 are predicted to generate more vehicle movements that Scenario 1. Therefore, more road links exceed the IAQM and EPUK screening criteria for a detailed assessment under Scenario 2, resulting in a larger road network being considered in the assessment.

44. More information on the derivation of the traffic flows is provided in Chapter 24 Traffic and Transport.

Table 26.8 Affected road links under Scenario 2

Link ID	Road	Scenario 2 - 2024 worst case assumptions Number of vehicles generated by the construction phase of the project (as AADT)	
		Total vehicles	HGVs
1a	A47	551	415
1b	A47	785	415
2	A47	691	291
3	A47	525	291
4	A47	369	291
5	A47	641	580
6	A47	604	580
7	A47	358	291
8	A146	322	291
9	A47	648	637
10	A47	640	637
13a	A148	683	595
13b	A148	508	453
14	A148	444	369
16	B1110/B1146 - Holt Road	352	224
17	B1145 - Billingford Road	320	224
18	A1067	388	313
19	A148	678	637
21	B1147 - Etling Green (Hoe Road South)	288	224
22	B1147 - Dereham Road	312	224
24	A1067	578	407
29	A1067	451	313
30	A1067	457	313
32	B1149 - Norwich Road	263	212
33	B1149 - Holt Road	385	212

Link ID	Road	Scenario 2 - 2024 worst case assumptions Number of vehicles generated by the construction phase of the project (as AADT)	
		Total vehicles	HGVs
34	B1145 - west of Cawston	388	224
35a	B1159 - Cost Road	390	294
35b	B1159 - Cost Road	326	263
36	B1149 - Holt Road	326	212
39	A140 - Hevingham	417	129
40a	A140 - Roughton	300	289
40b	A140 - Roughton	428	184
41	B1436 - Felbrigg	485	418
42	B1145 - Reepham Road	310	184
44a	A149	391	289
44b	A149	420	262
45	A149	320	206
46	B1145 - Lyngate Road	465	224
47c	North Walsham Road - Edingthorpe Green	203	184
49	B1159	214	184
52	A149 - Wayford Road	297	206
53	A149	634	630
54	A149	251	248
55	A149	251	248
56	A149	270	248
57	A149	271	248
58	NDR - Link a	487	453
59	NDR - Link b	472	453
60	NDR - Link c	400	313
64	A12	299	291
65	A47	639	637

Table 26.9 Affected road links under Scenario 1

Link ID	Road	Scenario 1 - 2024 worst case assumptions Number of vehicles generated by the construction phase of the project (as AADT)	
		Total vehicles	HGVs
1a	A47	124	100
1b	A47	172	100
5	A47	290	281
6	A47	284	281
9	A47	326	323
10	A47	324	323
13a	A148	336	323
13b	A148	215	206
14	A148	150	138
18	A1067	136	117
19	A148	335	323
24	A1067	211	167
29	A1067	164	117
30	A1067	147	117

Link ID	Road	Scenario 1 - 2024 worst case assumptions Number of vehicles generated by the construction phase of the project (as AADT)	
		Total vehicles	HGVs
34	B1145 - west of Cawston	200	131
40b	A140 - Roughton	287	197
41	B1436 - Felbrigg	145	138
53	A149	281	281
58	NDR - Link a	237	231
59	NDR - Link b	231	231
60	NDR - Link c	117	117
65	A47	323	323

26.4.1.2.2 Dispersion model

45. The potential impact of exhaust emissions from construction vehicles accessing the onshore project area was assessed using the Atmospheric Dispersion Modelling System for Roads (ADMS-Roads) v4.1.1. The main pollutants of concern for human health as a result of vehicle emissions are annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$, and annual mean emissions of NO_2 at designated ecological sites. Concentrations of these pollutants were therefore the focus of the ADMS-Roads assessment.

26.4.1.2.3 Assessment scenarios

46. The air quality assessment considered two assessment years which represents the maximum development-generated traffic and highest base traffic flows within the construction period for Scenario 1 and Scenario 2.

47. For Scenario 1, the onshore cable pulling works represents the maximum construction intensity period in terms of traffic and therefore informs the Worst Case Scenario (WCS). The onshore cable pulling works are programmed for a two year period (2026-2027) under Scenario 1.

48. The maximum intensity construction period under Scenario 2 is the duct installation / primary works period, which results in the maximum development-generated traffic. The duct installation works are programmed for a two year period (2023-2024) for Scenario 2.

49. The air quality assessment considered a peak year for both scenarios, which represents the maximum development-generated traffic added to the highest future baseline traffic flows within the construction period. The assessment has therefore considered the following:

- Verification / Base year (2017);
- Scenario 2 - Year of Peak Construction (2024) 'without project';

- Scenario 2 - Year of Peak Construction (2024) 'with the project';
- Scenario 1 - Year of Peak Construction (2027) 'without project'; and
- Scenario 1 - Year of Peak Construction (2027) 'with the project'.

50. A base year of 2017 was used as this was the most recent year for which monitoring data were available to verify the dispersion model.

26.4.1.2.4 Traffic data

51. 24-hour AADT flows and HGV percentages used in the assessment for Scenario 1 and Scenario 2 are detailed in Appendix 26.2.

52. Traffic speeds were included in the air dispersion modelling as follows:

- Queues were modelled at locations where assessed road links converge and on roundabouts at 20km/h; and
- Speed data for free-flowing traffic conditions obtained from national speed limits. Where speeds vary across a road link, the lowest speed was used to provide a conservative assessment. For the purposes of model verification, the road speed adjacent to the monitoring location was used to more adequately represent monitored conditions.

53. As the peak year for construction under Scenario 1 would occur when there is no construction phase traffic for Norfolk Vanguard, the baseline traffic scenario does not include construction phase traffic movements from Norfolk Vanguard.

26.4.1.2.5 Emission factors

54. Emission factors were obtained from the Emission Factor Toolkit v8.0.1 provided by Department of Environment, Food and Rural Affairs (Defra, 2017a). There is uncertainty regarding the rate of reduction in emissions from road vehicles in the future. To provide a conservative assessment, emission factors for the 2017 base year were used in the 2024 and 2027 'without project' and 'with project' assessment scenarios.

26.4.1.2.6 Meteorological data

55. 2017 meteorological data from the Norwich recording station was used in the ADMS-Roads model. This is the most centralised meteorological station within the study area.

26.4.1.2.7 Model verification

56. Model verification is the process of adjusting model outputs to improve the consistency of modelling results with respect to available monitored data. In this

assessment, model uncertainty was minimised following Defra (Defra, 2016) and IAQM and EPUK (IAQM and EPUK, 2017) guidance.

57. Monitoring locations in each Local Authority within the study area were reviewed to establish the suitability for use in model verification. Locations were only considered suitable where the assessed road links provided sufficient representation of road traffic sources that would affect monitored concentrations at that point. Monitoring locations that were situated in proximity to several road links which were not considered in the assessment were discounted on the basis that modelled concentrations would be underestimated.

58. A review of the monitoring data identified three NO_2 diffusion tubes located on the considered road network with available data for 2016 and 2017. These diffusion tubes are location 15 operated by North Norfolk District Council, location 1, operated by South Norfolk District Council and location DT1 operated by Great Yarmouth Borough Council.

59. Location 15, operated by North Norfolk District Council, had a data capture of less than 75% in 2016, and therefore was discounted from the verification process in accordance with Defra guidance (Defra, 2016). Monitoring data was not available for this location in 2017, therefore only diffusion tube location 1, operated by South Norfolk District Council and location DT1 operated by Great Yarmouth Borough Council were used for the verification process using a verification year of 2017.

60. Location 1, operated by South Norfolk District Council and location DT1 operated by Great Yarmouth Borough Council are located on the A47 and the A149 respectively (South Norfolk District Council, 2018; Great Yarmouth Borough Council Air Quality Annual Status Report, 2018).

61. The first round of verification showed that the difference between modelled and monitored concentrations was greater than 25% at location 1 operated by South Norfolk District Council. The diffusion tube is situated approximately 15m from the edge of the road, and therefore may be influenced by local conditions not captured in the model. This diffusion tube was therefore removed from the model verification process, in accordance with Defra Technical Guidance (Defra, 2016a).

62. Diffusion tube DT1, operated by Great Yarmouth Borough Council was therefore used in the derivation of the adjustment factor utilised in the assessment. Details of the model verification process are provided in Table 26.10.

Table 26.10 Model verification

Model verification	NO_2 diffusion tube monitoring location DT1
2017 Monitored Total NO_2 ($\mu g.m^{-3}$)	25.6
2017 Background NO_2 ($\mu g.m^{-3}$)	14.0
Monitored Road Contribution NOx (total - background) ($\mu g.m^{-3}$)	22.6
Modelled Road Contribution NOx (excludes background) ($\mu g.m^{-3}$)	13.7
Ratio of Monitored Road Contribution NOx / Modelled Road Contribution NOx	1.7
Adjustment Factor for Modelled Road Contribution	1.65576
Adjusted Modelled Road Contribution NOx ($\mu g.m^{-3}$)	22.6
Modelled Total NO_2 (based on empirical NOx / NO_2 relationship) ($\mu g.m^{-3}$)	25.6
Monitored Total NO_2 ($\mu g.m^{-3}$)	25.6
% Difference [(modelled - monitored) / monitored] x 100	0.00

63. The percentage difference between modelled and monitored oxides of nitrogen (NOx) concentrations is within the acceptable tolerances specified in Defra guidance (Defra, 2016). The model outputs were therefore adjusted using a factor of 1.6557.

26.4.1.2.8 NOx to NO_2 conversion

64. NOx concentrations were predicted using the ADMS-Roads model. The modelled road contribution of NO_x at the identified receptor locations was then converted to NO_2 using the NO_x to NO_2 calculator (v6.1) (Defra, 2017b), in accordance with Defra guidance (Defra, 2016).

26.4.1.2.9 Background pollutant concentrations

65. The ADMS-Roads assessment requires the derivation of background pollutant concentration data that are factored to the year of assessment, to which contributions from the assessed roads are added. Background NO_2, PM_{10} and $PM_{2.5}$ concentrations were therefore obtained for the 1km x 1km grid squares covering the onshore project area and receptor locations for the 2017 base year, from the latest 2015-based background maps (Defra, 2017c).

26.4.1.2.10 Calculation of short-term pollutant concentrations

66. Defra guidance (Defra, 2016) sets out the method for the calculation of the number of days, in which the PM_{10} 24-hour objective is exceeded, based on a relationship with the predicted PM_{10} annual mean concentration. The relevant calculation utilised in the prediction of short-term PM_{10} concentrations was:

No. 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206/annual mean)

67. Research projects completed on behalf of Defra and the Devolved Administrations (Laxen and Marner, 2003) (AEAT, 2008) concluded that the hourly mean NO_2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less than 60 Micrograms (of pollutant) per cubic meter (of air) ($\mu g.m^{-3}$). This value was therefore used as an annual mean equivalent threshold to evaluate likely exceedance of the hourly mean NO_2 objective.

26.4.1.2.11 Sensitivity – human receptors

68. The sensitivity of a human receptor is not considered in the assessment of air quality impacts; the Air Quality Objectives in Table 26.1, which are health-based, only apply at locations where there is relevant public exposure as detailed in Table 26.11.

Table 26.11 Examples of where the Air Quality Objectives should/should not apply

Averaging period	Objectives should apply at:	Objectives should generally not apply at:
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-Hour Mean and 8-Hour Mean	All locations where the annual mean objective would apply, together with hotels and gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-Hour Mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

69. Sensitive receptor locations that experience pollutant concentrations close to, or in exceedance of the objectives experience a larger impact magnitude with a smaller change in pollutant concentrations, as detailed below.

26.4.1.2.12 Magnitude and significance – human receptors

70. Guidance is provided by the IAQM and EPUK (IAQM and EPUK, 2017) on determining the magnitude and significance of a project's impact on local air quality. The guidance was developed specifically for use in planning and assessing air quality impacts associated with mixed-use and residential developments. However, due to the nature of the project, the criteria detailed below were utilised in the assessment to provide consideration of the impacts associated with the project.

71. The impact descriptors that take account of the magnitude of changes in pollutant concentrations, and the concentration in relation to the Air Quality Objectives, are detailed in Table 26.12.

Table 26.12 Impact descriptors for individual receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to the air quality objective			
	1	2 - 5	6 - 10	>10
75% or less of objective	Negligible	Negligible	Slight	Moderate
76 - 94% of objective	Negligible	Slight	Moderate	Moderate
95 - 102% of objective	Slight	Moderate	Moderate	Substantial
103 - 109 of objective	Moderate	Moderate	Substantial	Substantial
110% or more of objective	Moderate	Substantial	Substantial	Substantial

Note: Figures are to be rounded up to the nearest round number. Any value less than 1% after rounding (effectively less than 0.5%) will be described as "Negligible".

72. Further to the determination of the impact at individual receptors, the guidance recommends that assessment is made of the overall significance of the impact from a development on local air quality. The overall significance will need to take into account the following factors:

- The existing and future air quality in the absence of the project;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

73. The guidance also states that a judgement of the significance should be made by a competent professional who is suitably qualified. This air quality assessment and determination of the significance of the project on local air quality was undertaken by members of the IAQM.

26.4.1.2.13 Sensitivity – ecological receptors

74. Critical loads (CLs) for habitat sites in the UK are published on the Air Pollution Information System (APIS) website (Centre for Ecology and Hydrology (CEH), 2018). These are the maximum levels of nutrient nitrogen and acid deposition that can be tolerated without harm to the most sensitive features of these habitat sites.

26.4.1.2.14 Magnitude and significance – ecological receptors

75. Guidance provided by the Environment Agency (Environment Agency, 2017) states that where the contribution of a project leads to nutrient nitrogen deposition values below 1% of the CL, impacts can be considered to be not significant. Therefore, any project-generated nutrient nitrogen deposition values above 1% of the CL will require additional assessment by a qualified ecologist to determine whether any impacts may be experienced at the affected habitats.

26.4.2 Cumulative Impact Assessment

76. For a general introduction to the methodology used for the CIA, please refer to Chapter 6 EIA Methodology. This chapter focuses on those cumulative impacts that are specific to air quality.

26.4.3 Transboundary Impact Assessment

77. There are no transboundary implications with regard to air quality as the onshore project area is entirely within the UK and is not sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and will not be considered further.

26.5 Scope

26.5.1 Study Area

78. As agreed by the Planning Inspectorate in the Scoping Opinion (Planning Inspectorate, June 2017), the direct impact study area for air quality is limited to onshore construction and decommissioning impacts only.

79. Potential impacts associated with the construction and decommissioning of the project are as follows:

- Dust emissions; and
- Vehicle exhaust emissions.

80. Potential construction phase dust impacts were considered at existing sensitive receptor locations within 350m of the landfall, onshore cable route, onshore project substation and National Grid substation extension including overhead line

modifications, and within 50m of the edge of access roads that would be used by construction vehicles, up to 500m from the boundary of the works, in accordance with IAQM guidance (IAQM, 2014).

81. Impacts from construction vehicle exhaust emissions were considered at sensitive human and ecological receptor locations within 200m of site access routes which exceed the criteria detailed in Table 26.7, as shown in Figure 26.2 for Scenario 2 and Figure 26.4 for Scenario 1, as specified in DMRB guidance (Highways Agency, 2007). Further information on these routes is provided in Chapter 24 Traffic and Transport.

26.5.2 Data Sources

82. A summary of data sources utilised in the assessment is presented in Table 26.13.

Table 26.13 Data sources

Data	Link	Year	Coverage	Confidence	Notes
North Norfolk District Council Air Quality Annual Status Report	https://www.north-norfolk.gov.uk/media/3445/asr-2017.pdf	2017	North Norfolk District Council boundary	High	Local monitoring data and baseline information
Kings Lynn and West Norfolk Borough Council Air Quality Annual Status Report	https://www.west-norfolk.gov.uk/info/20137/air_quality/169/air_quality_information	2018	Kings Lyn and West Norfolk Borough Council boundary	High	Local monitoring data and baseline information
Great Yarmouth Borough Council Air Quality Annual Status Report	https://www.great-yarmouth.gov.uk/pollution	2018	Great Yarmouth Borough Council boundary	High	Local monitoring data and baseline information
South Norfolk Council Air Quality Annual Status Report	https://www.south-norfolk.gov.uk/sites/default/files/downloads/south_norfolk_asr_2018.pdf	2018	South Norfolk Council boundary	High	Local monitoring data and baseline information
Broadland District Council Annual Status Report	https://www.broadland.gov.uk/downloads/download/124/air_quality_documents	2018	Broadland District Council boundary	High	Local monitoring data and baseline information

Data	Link	Year	Coverage	Confidence	Notes
Breckland Council Air Quality Annual Status Report	https://www.breckland.gov.uk/media/10207/2018-Air-Quality-Annual-Status-Report-ASR-/pdf/Breckland_ASR_2018_Final.pdf	2018	Breckland Council boundary	High	Local monitoring data and baseline information
Suffolk Coastal District Council and Waveney District Council Air Quality Annual Status Report	http://www.eastsuffolk.gov.uk/assets/Environment/Environmental-Protection/Air-Quality/ASR-2018-SCDC-and-WDC-Final-Sept-2018.pdf	2018	Waveney District Council boundary	High	Local monitoring data and baseline information
Department for Environment Food and Rural Affairs (Defra) Local Air Quality Management Technical Guidance	https://laqm.defra.gov.uk/documents/LAQM-PG16-April-16-v1.pdf	2016	UK	High	Assessment methodology
Defra's LAQM Support Portal	https://laqm.defra.gov.uk/	2015	Study area	High	1 x 1km grid pollutant background maps
CEH	http://www.apis.ac.uk/	2019	UK	High	Details of CLs for habitats
IAQM and Environmental Protection UK	http://www.environmental-protection.org.uk/epukiaqm-planning-guidance/	2017	UK	High	Assessment methodology
IAQM	http://iaqm.co.uk/	2014	UK	High	Guidance on the assessment of impacts from construction dust

26.5.3 Assumptions and Limitations

83. Traffic data was utilised in the prediction of impacts at sensitive human and ecological receptor locations. Any assumptions made in the derivation of the traffic data under Scenario 1 and Scenario 2 are therefore also applicable to the air quality assessment. For further details please refer to Chapter 24 Traffic and Transport.

26.6 Existing Environment

84. A desk based review was undertaken to determine the air quality baseline within the study area. Monitoring data were obtained from the following Local Authority websites for use in the ES:

- North Norfolk District Council;
- Broadland District Council;
- Breckland Council;
- Great Yarmouth Borough Council;
- South Norfolk District Council;
- Waveney District Council; and
- Kings Lynn and West Norfolk Borough Council.

26.6.1 Local Air Quality Management

85. A review of the annual air quality review and assessment reports for the seven identified Local Authorities identified that the onshore cable route and associated affected road network do not pass through any statutory designated AQMAs. The statutory designated AQMA in Swaffham, declared in May 2017, is located approximately 1km south of the A47, which forms part of the affected road network. However, as project-generated traffic would not pass through the AQMA itself, it is not anticipated that given the distance there would be any significant increases in pollutant concentrations within the AQMA.

26.6.2 Air Quality Monitoring Data

26.6.2.1 North Norfolk District Council

86. There were seven NO_2 diffusion tube locations in the vicinity of the onshore cable route or associated affected road network considered in the assessment in 2016. The results were obtained from the latest available 2017 Annual Status Report (North Norfolk District Council, 2017) and are presented in Table 26.14.

Table 26.14: Annual mean NO_2 monitoring undertaken North Norfolk District Council

Site ID	Location	Site type	2016 Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)
3	Grammar School Road, North Walsham	Roadside	20.2
4	Angel Court, North Walsham	Roadside	17.6
7	Riverside Road, Letheringsett	Roadside	6.5
9	Queens Road, Fakenham	Roadside	21.6
10	Barons Hall Road, Fakenham	Roadside	7.5
12	High Street, Holt	Roadside	19.3
15	Holt Road, Letheringsett	Roadside	17.1

87. As detailed in Table 26.14, annual mean NO_2 concentrations were below the 40µg.m^3 objective value at all monitoring locations in the study area in 2016.

26.6.2.2 Broadland District Council

88. Broadland District Council does not undertake automatic air pollution monitoring; however, diffusion tube monitoring is undertaken at 16 locations in the district. Three of these locations are situated in the vicinity of the A47, which were considered in the road traffic emissions assessment. Monitoring results from these locations from 2013 to 2017 were obtained from the 2018 Broadland District Council Annual Status Report (Broadland District Council, 2018), and are presented in Table 26.15.

Table 26.15 Annual mean NO_2 monitoring undertaken by Broadland District Council

Site ID	Location	Site type	Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)				
			2013	2014	2015	2016	2017
BN1	A47 North Burlingham	Kerbside	33.7	30.8	28.4	30.6	23.9
BN2	Norwich Rd, Acle	Kerbside	23.5	21.6	18.3	19.3	16.6
BN3	Cox Hill, Beighton	Roadside	17.9	16.5	13.3	14.4	14.4

89. As detailed in Table 26.15, annual mean NO_2 concentrations were below the 40µg.m^3 objective value at all monitoring locations in the study area in 2013 to 2017.

26.6.2.3 Breckland Council

90. Breckland Council undertakes automatic and diffusion tube monitoring within its area of jurisdiction. Monitoring is undertaken at three diffusion tube locations in Dereham and at several locations within the Swaffham AQMA. Recent monitoring data were obtained from the 2018 Annual Status Report (Breckland Council, 2018) and are detailed in Table 26.16. Exceedances of the annual mean objective are shown in bold text.

Table 26.16 Annual mean NO_2 monitoring undertaken by Breckland Council

Site ID	Location	Site type	Monitored annual mean NO_2 concentration ($\mu g.m^{-3}$)				
			2013	2014	2015	2016	2017
D1	Dereham	Urban Centre	36.8	35.4	33.9	34.3	30.9
D2	Dereham	Urban Background	20.2	28.6	27.8	28.6	25.0
D3	Dereham	Urban Centre	26.2	14.7	N/A	11.2	13.7
S3 (Auto)	Swaffham	Roadside	33.0	33.0	29.0	28.0	24.9
S1	Swaffham	Urban Centre	25.9	25.3	22.6	24.2	20.2
S2	Swaffham	Urban Centre	19.7	38.5	37.3	38.4	33.5
S3	Swaffham	Roadside	33.2	33.7	28.9	31.4	25.2
S3a	Swaffham	Roadside	34.3	32.6	29.5	30.0	26.1
S3b	Swaffham	Roadside	32.6	32.7	29.0	30.2	26.0
S4	Swaffham	Roadside	30.1	28.7	25.2	26.9	20.9
S5	Swaffham	Roadside	30.7	28.6	25.9	25.7	22.7
S6	Swaffham	Roadside	35.1	34.3	31.1	33.2	29.1
S7	Swaffham	Roadside	36.4	34.9	34.8	38.4	29.7
S8	Swaffham	Roadside	**41.6**	**40.4**	37.7	**41.0**	34.3
S9	Swaffham	Roadside	30.7	28.2	26.4	26.7	21.9
S10	Swaffham	Roadside	28.0	25.9	24.7	24.9	22.7
S11	Swaffham	Roadside	36.7	35.6	34.0	37.0	30.6
S12	Swaffham	Roadside	35.7	34.4	31.4	32.0	29.2
S13	Swaffham	Roadside	26.8	25.7	25.0	26.4	21.7
S14	Swaffham	Roadside	31.6	27.5	22.9	24.2	21.2

91. As detailed in Table 26.16, annual mean NO_2 concentrations were in exceedance of the objective ($40\mu g.m^{-3}$) at one roadside location within the recently-declared Swaffham AQMA. Monitoring locations in Dereham were below the annual mean objective across the five year period. There was a large change in concentrations at location S2 between 2013 and 2014; there is no information available in the annual report, however this may be due to a change in location or introduction of a new pollution source in the vicinity of the diffusion tube.

26.6.2.4 Great Yarmouth Borough Council

92. There are 2 NO_2 diffusion tube locations in the vicinity of the affected road network that are operated by Great Yarmouth Borough Council. Monitoring data were obtained from the 2018 Annual Status Report (Great Yarmouth Borough Council, 2018) and are presented in Table 26.17.

Table 26.17 Annual mean NO_2 monitoring undertaken by Great Yarmouth Borough Council

Site	Type	Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)				
		2013	2014	2015	2016	2017
DT1	Roadside	22.1	22.0	21.9	21.1	25.6
DT2	Roadside	24.0	24.1	22.5	21.2	20.9
DT3	Roadside	25.4	26.9	25.4	24.4	21.8
DT4	Roadside	37.5	37.8	37.4	33.2	26.7
DT5	Roadside	25.3	23.5	23.8	22.9	21.7

Site	Type	Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)				
		2013	2014	2015	2016	2017
DT6	Roadside	25.8	25.6	24.4	22.2	22.3
DT7	Roadside	20.8	22.9	20.9	20.3	19.0
DT8 (Triplicate site)	Urban background	18.2	17.8	16.0	17.7	18.8
	Urban background	14.3	16.9	16.3	17.7	18.3
	Urban background	17.2	15.4	15.7	17.1	18.4
DT9	Roadside	20.2	18.7	19.9	18.5	18.8
DT10	Roadside	34.0	30.6	32.8	33.7	33.2
DT11	Roadside	N/A	N/A	31.6	27.4	27.9
DT12	Roadside	N/A	N/A	N/A	24.9	20.0

93. As detailed in Table 26.17, concentrations were approaching the annual mean NO_2 objective ($40\mu g.m^{-3}$) at location DT4 from 2013 - 2015. This location is close to a major road in the town centre where congestion may be experienced. There was a decrease in NO_2 concentrations in 2016 and 2017 at this location. Concentrations at other locations were below the annual mean objective.

26.6.2.5 Kings Lynn and West Norfolk Borough Council

94. A review of the 2018 Annual Status Report (Kings Lynn and West Norfolk Borough Council, 2018) identified that no monitoring was undertaken in the vicinity of the onshore cable route or roads considered in the assessment.

26.6.2.6 South Norfolk District Council

95. There are four diffusion tubes operated by South Norfolk District Council that are located in the vicinity of the affected road network. Monitoring results were obtained from the 2018 South Norfolk District Council Annual Status Report (South Norfolk District Council, 2018) and are presented in Table 26.18.

Table 26.18 Annual mean NO_2 monitoring undertaken by South Norfolk District Council

Site	Type	Monitored annual mean NO_2 concentration ($\mu g.m^{-3}$)				
		2013	2014	2015	2016	2017
1	Suburban	19.5	21.5	17.1	20.2	21.2
6	Suburban	13.0	12.0	10.4	13.5	20.2
9	Roadside	22.8	26.7	21.4	25.4	24.9
11	Suburban	15.0	15.9	12.8	15.8	14.9
29	Suburban	38.9	38.6	31.8	38.2	30.4

96. Results shown in Table 26.18 show that pollutant concentrations were approaching the annual mean NO_2 objective ($40\mu g.m^{-3}$) at location 29 in 2013, 2014 and 2016. Annual mean NO_2 concentrations at all other locations were below the air quality objective.

26.6.2.7 Waveney District Council

97. There are six diffusion tube locations situated in proximity to the affected road network; recent data for these sites, obtained from the Waveney District Council 2018 Annual Status Report (Waveney District Council, 2018), are detailed in Table 26.19.

Table 26.19 Annual mean NO_2 monitoring undertaken by Waveney District Council

Site	Type	Monitored annual mean NO_2 concentration ($\mu g.m^{-3}$)				
		2013	2014	2015	2016	2016
DT1	Roadside	16.2	15.2	14.8	15.2	19.2
DT7	Roadside	19.6	18.7	17.6	18.1	24.4
DT9	Roadside	24.0	29.3	31.1	28.5	33.8
DT11	Roadside	35.3	29.9	24.8	27.2	29.8
DT14	Roadside	32.3	31.6	28.4	27.2	27.6
DT15	Roadside	33.2	23.9	23.5	25.3	28.1

98. As detailed in Table 26.19, pollutant concentrations were below the annual mean objective in recent years ($40\mu g.m^{-3}$).

26.6.3 Background Pollutant Concentrations

99. Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were obtained from the air pollutant concentration maps provided by Defra for the grid squares covering the study area. 2017 background concentrations were used for all 2024 and 2027 assessment years to provide a conservative assessment. The highest and lowest background concentrations within each Local Authority boundary are detailed in Table 26.20. The full table of background concentrations used in the assessment is provided in Appendix 26.3.

Table 26.20 Background pollutant concentrations

Local Authority	Annual mean background concentration ($\mu g.m^{-3}$)					
	NO_2		PM_{10}		$PM_{2.5}$	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Kings Lynn and West Norfolk District Council	8.36	10.53	13.41	13.99	8.78	9.22
Breckland Council	7.59	9.45	12.91	15.26	8.55	9.61
North Norfolk District Council	7.75	9.98	11.90	15.63	7.88	10.50
Broadland District Council	7.72	13.00	16.65	15.27	8.50	9.99
Waveney District Council	9.11	11.62	13.09	16.36	8.92	12.17
South Norfolk District Council	9.36	15.19	13.72	15.74	8.96	10.12
Great Yarmouth Borough Council	8.62	13.96	12.52	17.46	8.66	13.17

100. As detailed in Table 26.20, background pollutant concentrations were 'well below' (e.g. less than 75% of) the relevant Air Quality Objectives. This is to be expected in areas that are largely rural in nature.

26.6.4 Identification of Receptor Locations

26.6.4.1 Construction phase dust assessment

101. The IAQM guidance (IAQM, 2014) states that a Detailed Assessment is required where there are human receptors within 350m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s). Ecological receptors within 50m of the site boundary or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s), are also identified at this stage.

102. Receptor locations were identified in the areas closest to the anticipated maximum construction dust impact (as defined in section 26.7.4) within the study area, taking into account the following:

- There are human receptors within 350m of the onshore infrastructure and within 50m of the planned construction vehicle route up to 500m from the boundary; and
- There are no designated ecological receptors within 50m of the onshore construction activity or within 50m of the planned construction vehicle routes, up to 500m from the project boundary.

103. A Detailed Assessment was therefore required to assess the impact of dust during the construction phase at the identified human receptor locations.

104. The worst case area for construction phase dust emissions for both Scenario 1 and Scenario 2 was considered to be the area around North Walsham; where there were receptors identified within 350m of the onshore cable route and within 50m of construction vehicle access routes. In addition, for Scenario 2 only, receptors were identified within 350m of mobilisation areas and trenchless crossing zones (e.g. Horizontal Directional Drilling (HDD)).

26.6.4.2 Construction vehicle exhaust emissions assessment

26.6.4.2.1 Human receptors

105. Existing sensitive receptor locations were identified within the study area for consideration in the assessment. Predicted changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations as a result of project-generated traffic were calculated at these locations.

106. The sensitive receptor locations were selected based on their proximity to road links affected by the project separately for Scenario 1 and Scenario 2, where the potential

effect of project-generated traffic emissions on local air pollution would be most significant. The sensitive receptor locations are detailed in Table 26.21 (Figure 26.2) for Scenario 2 and in Table 26.22 (Figure 26.4) for Scenario 1. There would be less development-generated traffic associated with Scenario 1 as duct installation and other shared enabling works would have been undertaken by Norfolk Vanguard. Therefore, the road network and number of receptors considered for the Scenario 1 assessment was less than for Scenario 2. The Receptor IDs were kept the same across both scenarios for comparison purposes.

Table 26.21 Sensitive human receptor locations for Scenario 2

Local Authority	Receptor ID	OS grid reference (m)	
		X	Y
Breckland Council	R3	585205	309742
	R4	590481	312144
	R9	598299	318090
	R10	600092	320205
	R11	600339	320205
	R12	603929	320774
	R15	604356	320508
	R16	606595	319493
	R22	606212	313494
	R80	596695	315090
	R81	597615	314647
	R82	601096	315822
	R83	598467	315195
	R87	604811	320782
Broadland District Council	R17	613423	323934
	R18	613576	323867
	R19	610105	318269
	R20	612718	316784
	R21	614016	315749
	R35	630874	309049
	R36	638372	310073
	R42	621610	317564
	R43	620205	321628
	R49	620220	326217
	R69	618338	315180
	R70	621335	314385
	R71	629117	308859
	R75	615339	324073
	R76	616422	322177
	R77	619234	316215
	R79	614695	325494
	R85	619234	316216
	R86	619414	315931
	R88	606295	321999

Local Authority	Receptor ID	OS grid reference (m)	
		X	Y
Great Yarmouth Borough Council	R33	652239	302281
	R34	651499	307173
	R37	650033	308960
	R38	652311	308930
	R39	652390	310559
	R40	651452	311763
	R41	651370	312065
	R67	642448	317685
	R68	646539	315190
	R72	619625	330553
King's Lynn and West Norfolk Borough Council	R1	619253	329447
	R2	607826	338305
North Norfolk District Council	R5	609780	334388
	R6	611713	330096
	R7	595352	331138
	R8	598765	333396
	R13	593612	330224
	R14	597893	327717
	R44	612720	340277
	R45	612603	340164
	R46	621445	339010
	R47	621761	337119
	R48	621993	337075
	R50	621991	336875
	R51	622278	336855
	R52	624100	335948
	R53	624111	335641
	R54	615339	324073
	R55	616422	322177
	R56	619234	316215
	R57	614695	325494
	R58	636094	325430
	R59	636598	327846
	R60	636267	325362
	R61	638254	323928
	R62	638046	324180
	R63	628385	329266
	R64	633145	324507
	R65	634629	324124
	R66	634894	324905
	R73	607826	338305
	R74	609780	334388
	R78	611713	330096
	R84	628583	331688
South Norfolk District Council	R23	613987	310979
	R24	619708	304357
	R25	622272	304317
	R26	631000	302280
	R27	639280	293623
	R89	627470	307758

Local Authority	Receptor ID	OS grid reference (m)	
		X	Y
Waveney District Council	R28	651310	290514
	R29	652149	290432
	R30	654621	294752
	R31	653844	295236
	R32	652905	297411

Table 26.22 Sensitive human receptor locations for Scenario 1

Local Authority	Receptor ID	OS grid reference (m)	
		X	Y
Breckland Council	R3	585205	309742
	R4	590481	312144
	R12	603929	320774
	R15	604356	320508
	R16	606595	319493
Broadland District Council	R17	613423	323934
	R18	613576	323867
	R19	610105	318269
	R20	612718	316784
	R21	614016	315749
	R35	630874	309049
	R36	638372	310073
	R49	620220	326217
	R69	618338	315180
	R70	621335	314385
	R71	629117	308859
Great Yarmouth Borough Council	R33	652239	302281
	R34	651499	307173
	R37	650033	308960
	R72	619625	330553
North Norfolk District Council	R5	609780	334388
	R6	611713	330096
	R7	595352	331138
	R8	598765	333396
	R13	593612	330224
	R14	597893	327717
	R44	612720	340277
	R45	612603	340164
	R46	621445	339010
	R47	621761	337119
	R48	621993	337075
	R50	621991	336875
Waveney District Council	R30	654621	294752
	R31	653844	295236
	R32	652905	297411

26.6.4.2.2 Designated ecological sites

107. A number of designated ecological sites are located within 200m of roads which are anticipated to experience increases in traffic flows above those detailed in Table

26.7. The APIS website (CEH, 2018) was consulted to identify any habitats or features of these designated sites that are sensitive to nutrient nitrogen deposition. Where sensitive habitats or features were found, the CLs for nutrient nitrogen deposition were obtained. The designated ecological sites considered in the assessment and associated CL values are detailed in Table 26.23 and shown in Figure 26.5.

Table 26.23 Designated ecological sites and CL values

Designated ecological site	Habitat or feature	CL ($kgN.ha^{-1}.y^{-1}$)
Breydon Water Site of Special Scientific Interest (SSSI)	Littoral sediment/ wigeon, shelduck	20
Felbrigg Woods SSSI	Broadleaved, mixed and yew woodland	10
Broadland Special Protection Area (SPA)	Eurasian marsh harrier Eurasian wigeon Great bittern	15
The Broads Special Area of Conservation (SAC)	Floodplain and coastal grazing marsh	20
Cawston and Marsham Heaths SSSI	Dry heaths	10
Buxton Heath SSSI	Dwarf shrub heath	10
Holt Lowes SSSI	Fen, marsh and swamp/ dwarf shrub heath	10
Foxley Wood SSSI	Broadleaved, mixed and yew woodland	10
East Winch Common SSSI	Dwarf shrub heath	10
Holly Farm Meadow, Wendling SSSI	Neutral grassland and, fen, marsh and swamp	15
Potter & Scarning Fens, East Dereham SSSI	Fen, marsh and swamp	15
Beetley & Hoe Meadows SSSI	Fen, marsh and swamp	15
River Wensum SSSI	Fen, marsh and swamp	15

108. In accordance with DMRB guidance (Highways Agency, 2007), receptors were included in the model as transects through the designated site, at 50m intervals set back from the road up to 200m. Where a designated site spans both sides of a road, two transects were included in the dispersion model to account for this. The transects for each designated site considered for Scenario 2 are shown in Figure 26.5 and the locations are detailed in Table 26.24.

Table 26.24 Ecological receptor transects considered under Scenario 2

Designated Ecological Site	Transect ID	OS Grid Reference (m)	
		X	Y
Felbrigg Woods SSSI	T1-1	620036	340699
	T1-2	620036	340649
	T1-3	620036	340599
	T1-4	620036	340549
	T1-5	620036	340499
	T1-6	620036	340485
Broadland SPA	T2-1	638227	323592
	T2-2	638180	323574
	T2-3	638156	323565
The Broads SAC	T3-1	646327	315260
	T3-2	646299	315219
	T3-3	646270	315178
	T3-4	646242	315137
	T3-5	646219	315102
	T4-1	646334	315272
	T4-2	646363	315313
	T4-3	646392	315354
	T4-4	646421	315394
	T4-5	646449	315433
Breydon Water SSSI	T5-1	651013	308889
	T5-2	651014	308839
	T5-3	651015	308789
	T5-4	651016	308739
	T5-5	651017	308720
	T6-1	651691	308175
	T6-2	651645	308197
	T6-3	651600	308218
	T6-4	651555	308240
	T6-5	651516	308258
Broadland SPA	T7-1	648444	290539
	T7-2	648417	290581
	T7-3	648391	290624
	T7-4	648370	290658
	T8-1	641409	309999
	T8-2	641389	309953
	T8-3	641369	309907
	T8-4	641349	309862
	T8-5	641331	309820
Cawston and Marsham Levels SSSI	T9-1	615596	323892
	T9-2	615605	323896
Buxton Heath SSSI	T10-1	617007	321319
	T10-2	617051	321342
	T10-3	617100	321367
	T10-4	617144	321391
Holt Lowes SSSI	T11-1	608315	337015
	T11-2	608360	337033
	T11-3	608404	337051
	T11-4	608450	337068
	T11-5	608496	337086

Designated Ecological Site	Transect ID	OS Grid Reference (m)	
		X	Y
Foxley Wood SSSI	T12-1	605363	321763
	T12-2	605351	321782
East Winch Common SSSI	T13-1	570358	315939
	T13-2	570328	315911
	T13-3	570295	315880
	T13-4	570257	315845
	T13-5	570214	315805
Holly Meadow Farm SSSI	T14-1	593581	313000
	T14-2	593582	313043
	T14-3	593582	313083
	T14-4	593584	313125
	T14-5	593585	313170
Potter and Scarning Fens SSSI	T15-1	598174	312265
	T15-2	598165	312227
	T15-3	598154	312179
	T15-4	598143	312130
	T15-5	598130	312074
Beetley and Hoe Meadows SSSI	T16-1	598290	317387
	T16-2	598247	317386
	T16-3	598204	317386
	T16-4	598154	317386
	T16-5	598100	317386
River Wensum SSSI	T17-1	612819	316741
	T17-2	612815	316780
	T17-3	612801	316816
	T17-4	612786	316855
	T17-5	612765	316897
	T18-1	612821	316732
	T18-2	612824	316694
	T18-3	612833	316649
	T18-4	612849	316607
	T18-5	612865	316564

109. Due to the smaller road network considered for the Scenario 1 assessment, only the Felbrigg Woods SSSI (T1), Breydon Water SSSI (T5 and T6), Broadland SPA (T8), Holly Meadow Farm SSSI (T14), Potter and Scarning Fens SSSI (T15) and River Wensum SSSI (T17 and T18) designated ecological sites were considered in the assessment. The transects for each designated site are shown in Figure 26.5 and the locations are detailed in Table 26.25.

Table 26.25 Ecological receptor transects considered under Scenario 1

Designated Ecological Site	Transect ID	OS Grid Reference (m)	
		X	Y
Felbrigg Woods SSSI	T1-1	620036	340699
	T1-2	620036	340649
	T1-3	620036	340599
	T1-4	620036	340549
	T1-5	620036	340499
	T1-6	620036	340485
Breydon Water SSSI	T5-1	651013	308889
	T5-2	651014	308839
	T5-3	651015	308789
	T5-4	651016	308739
	T5-5	651017	308720
	T6-1	651691	308175
	T6-2	651645	308197
	T6-3	651600	308218
	T6-4	651555	308240
	T6-5	651516	308258
Broadland SPA	T8-1	641409	309999
	T8-2	641389	309953
	T8-3	641369	309907
	T8-4	641349	309862
	T8-5	641331	309820
Holly Meadow Farm SSSI	T14-1	593581	313000
	T14-2	593582	313043
	T14-3	593582	313083
	T14-4	593584	313125
	T14-5	593585	313170
Potter and Scarning Fens SSSI	T15-1	598174	312265
	T15-2	598165	312227
	T15-3	598154	312179
	T15-4	598143	312130
	T15-5	598130	312074
River Wensum SSSI	T17-1	612819	316741
	T17-2	612815	316780
	T17-3	612801	316816
	T17-4	612786	316855
	T17-5	612765	316897
	T18-1	612821	316732
	T18-2	612824	316694
	T18-3	612833	316649
	T18-4	612849	316607
	T18-5	612865	316564

26.6.5 Baseline Road Traffic Emissions

110. The ADMS-Roads model was used to estimate contributions of vehicle exhaust emissions to annual and short term NO_2, PM_{10} and $PM_{2.5}$ concentrations for the 2017 base year, and the 2024 and 2027 year of peak construction 'without project' assessments for Scenario 2 and Scenario 1. The 24-hour AADT flows and HGV percentages used in the assessment are detailed in Appendix 26.2. Table 26.26 and Table 26.27 provide the results of the baseline assessment for the base year and Scenario 2 and Scenario 1 respectively.

Table 26.26 Baseline road traffic emissions assessment base year and 2024 Scenario 2

Local Authority	Receptor ID	Base year (2017) (µg.m^{-3})			Scenario 2 - Year of peak construction (2024) 'without project' (µg.m^{-3})		
		NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
Breckland Council	R3	16.10	14.14	9.18	17.16	14.23	9.24
	R4	18.76	15.56	9.90	20.10	15.68	9.97
	R9	11.74	15.57	9.78	12.29	15.61	9.81
	R10	8.47	12.98	8.59	8.60	12.99	8.60
	R11	9.16	13.52	8.87	9.39	13.53	8.88
	R12	8.99	14.59	9.47	9.16	14.61	9.48
	R15	9.79	15.14	10.07	9.98	15.15	10.08
	R16	18.20	16.02	10.59	19.48	16.16	10.67
	R22	14.93	13.11	8.78	15.69	13.18	8.82
	R80	7.88	13.74	8.97	8.21	13.77	8.99
	R81	8.09	14.45	9.51	8.76	14.50	9.54
	R82	8.50	15.76	10.13	9.22	15.82	10.16
	R83	10.29	15.24	9.73	10.62	15.27	9.75
	R87	9.63	14.98	10.50	9.80	15.00	10.51
Broadland District Council	R17	10.03	13.83	8.84	10.28	13.85	8.85
	R18	9.22	13.59	8.89	9.37	13.61	8.89
	R19	12.91	14.39	9.26	13.43	14.44	9.29
	R20	16.01	15.10	9.87	16.99	15.21	9.94
	R21	11.52	15.42	9.89	11.93	15.46	9.92
	R35	25.23	14.56	9.99	26.20	14.66	10.04
	R36	26.88	17.13	12.30	27.86	17.22	12.36
	R42	14.26	14.15	9.40	14.64	14.19	9.42
	R43	11.87	13.21	8.85	12.11	13.23	8.86
	R49	15.75	14.95	9.45	16.60	15.03	9.50
	R69	9.65	14.68	9.69	14.55	15.17	9.97
	R70	12.28	13.90	9.32	22.83	14.98	9.96
	R71	14.91	15.11	10.16	34.06	17.19	11.39
	R75	12.34	13.75	8.35	12.93	13.79	8.38
	R76	16.50	15.41	10.08	17.61	15.50	10.14
	R77	12.27	14.46	9.31	12.86	14.51	9.34
	R79	10.80	14.76	9.84	11.19	14.80	9.86
	R85	12.37	15.17	9.97	12.97	15.22	10.00
	R86	18.43	15.48	10.88	19.76	15.59	10.95
	R88	8.76	16.44	12.22	8.92	16.46	12.22

Local Authority	Receptor ID	Base year (2017) (µg.m^{-3})			Scenario 2 - Year of peak construction (2024) 'without project' (µg.m^{-3})		
		NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
Great Yarmouth Borough Council	R33	18.80	15.80	10.19	19.74	15.90	10.26
	R34	24.04	15.19	9.68	25.38	15.36	9.78
	R37	16.60	13.85	8.99	17.37	13.92	9.03
	R38	20.94	18.19	13.59	21.87	18.29	13.65
	R39	21.36	13.68	9.34	22.79	13.84	9.43
	R40	11.60	13.08	8.78	11.88	13.11	8.80
	R41	13.61	13.37	9.09	14.14	13.42	9.12
	R67	17.01	15.43	10.12	17.62	15.49	10.16
	R68	14.20	14.41	9.35	14.93	14.49	9.39
	R72	24.88	14.25	9.44	26.25	14.40	9.53
King's Lynn and West Norfolk Borough Council	R1	23.32	15.70	9.84	24.92	15.86	9.93
	R2	15.87	14.42	9.29	16.86	14.50	9.34
North Norfolk District Council	R5	11.52	14.99	9.55	11.98	15.04	9.58
	R6	11.71	14.81	9.41	12.19	14.86	9.44
	R7	13.63	15.27	9.91	14.32	15.34	9.95
	R8	11.65	14.18	9.23	12.14	14.22	9.26
	R13	12.36	14.88	9.53	12.68	14.91	9.55
	R14	13.91	15.34	9.95	14.73	15.42	10.00
	R44	13.05	17.94	13.45	13.70	18.00	13.49
	R45	13.69	14.53	9.53	14.42	14.60	9.58
	R46	10.18	13.59	8.89	10.51	13.61	8.90
	R47	12.44	15.82	10.38	13.03	15.86	10.41
	R48	13.11	14.34	9.13	13.77	14.40	9.17
	R50	12.98	15.01	9.50	13.62	15.06	9.53
	R51	8.55	13.22	8.59	8.65	13.23	8.59
	R52	12.89	16.10	9.90	13.54	16.17	9.94
	R53	11.83	14.79	9.36	12.34	14.84	9.39
	R54	11.61	13.84	8.97	11.86	13.86	8.98
	R55	10.49	13.79	8.94	10.64	13.80	8.94
	R56	9.42	13.74	9.09	9.61	13.76	9.09
	R57	10.07	14.38	9.49	10.40	14.41	9.50
	R58	13.19	14.62	9.62	13.76	14.68	9.66
	R59	10.10	14.76	9.57	10.38	14.78	9.59
	R60	12.02	13.70	8.99	12.44	13.74	9.02
	R61	11.50	13.83	9.07	11.83	13.86	9.09
	R62	13.64	14.10	9.23	14.30	14.17	9.27
	R63	12.99	15.12	10.71	13.49	15.17	10.74
	R64	10.98	14.71	9.80	11.25	14.74	9.81
	R65	13.82	13.42	8.94	14.37	13.48	8.98
	R66	14.10	12.37	8.39	14.68	12.43	8.43
	R73	11.71	13.72	8.01	12.09	13.75	8.03
	R74	9.06	13.51	8.20	9.24	13.53	8.21
	R78	9.81	15.28	10.21	10.06	15.30	10.22
	R84	12.33	15.08	9.64	12.76	15.12	9.66

Local Authority	Receptor ID	Base year (2017) (µg.m^{-3})			Scenario 2 - Year of peak construction (2024) 'without project' (µg.m^{-3})		
		NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
South Norfolk District Council	R23	14.06	13.79	9.06	14.73	13.85	9.10
	R24	15.67	14.05	9.21	16.04	14.08	9.23
	R25	16.84	14.46	9.44	17.35	14.50	9.46
	R26	13.47	14.72	9.76	14.02	14.77	9.80
	R27	16.83	16.08	10.42	17.80	16.19	10.48
	R89	21.29	14.01	9.75	22.16	14.09	9.79
Waveney District Council	R28	12.93	14.42	9.35	13.30	14.46	9.37
	R29	15.21	13.89	8.99	15.73	13.94	9.02
	R30	17.75	14.51	9.59	18.56	14.60	9.64
	R31	13.21	14.16	9.20	13.58	14.20	9.22
	R32	19.86	15.09	9.92	21.28	15.25	10.02
Annual mean NO_2 and PM_{10} Objective - 40µg.m^{-3} Annual mean $PM_{2.5}$ target value - 25µg.m^{-3}							

Table 26.27 Baseline road traffic emissions assessment for 2027 Scenario 1

Local Authority	Receptor ID	Scenario 1 - Year of peak construction (2027) 'without project' (µg.m^{-3})		
		NO_2	PM_{10}	$PM_{2.5}$
Breckland Council	R3	17.54	14.27	9.26
	R4	20.57	15.73	10.00
	R12	9.22	14.61	9.48
	R15	10.04	15.16	10.08
	R16	19.92	16.21	10.70
Broadland District Council	R17	10.36	13.86	8.85
	R18	9.41	13.61	8.90
	R19	13.6	14.46	9.30
	R20	17.33	15.24	9.96
	R21	12.05	15.47	9.93
	R35	26.57	14.69	10.06
	R36	28.26	17.26	12.38
	R49	16.88	15.06	9.52
	R69	14.88	15.20	9.99
	R70	23.64	15.07	10.01
	R71	35.15	17.32	11.46
Great Yarmouth Borough Council	R33	20.06	15.94	10.28
	R34	25.85	15.41	9.81
	R37	17.64	13.94	9.04
	R72	26.74	14.45	9.56
North Norfolk District Council	R5	12.14	15.06	9.59
	R6	12.36	14.88	9.45
	R7	14.56	15.36	9.96
	R8	12.3	14.24	9.27
	R13	12.8	14.92	9.56
	R14	15.01	15.45	10.01
	R44	13.92	18.03	13.50
	R45	14.67	14.63	9.59
	R46	10.61	13.62	8.91
	R47	13.22	15.88	10.42

Local Authority	Receptor ID	Scenario 1 - Year of peak construction (2027) 'without project' (µg.m^{-3})		
		NO_2	PM_{10}	$PM_{2.5}$
	R48	13.99	14.42	9.18
	R50	13.83	15.07	9.54
Waveney District Council	R30	18.83	14.63	9.66
	R31	13.70	14.21	9.23
	R32	21.76	15.30	10.05
Annual mean NO_2 and PM_{10} Objective - 40µg.m^{-3} Annual mean $PM_{2.5}$ target value - 25µg.m^{-3}				

111. As detailed in Table 26.26 and Table 26.27, annual mean NO_2, PM_{10} and $PM_{2.5}$ were predicted to be below the relevant objectives in the 2017 base year and 2024 and 2027 'without project' assessments for Scenario 2 and Scenario 1.

112. All predicted NO_2 concentrations were 'well below' 60µg.m^{-3} and therefore, in accordance with Defra guidance (Defra 2016), the 1-hour mean objective is unlikely to be exceeded (see Table 26.1). The short term PM_{10} objective was predicted to be met at all modelled locations (objective being less than 35 exceedances of the daily mean objective of 50µg.m^{-3}).

26.6.6 Anticipated Trends in Baseline Conditions

113. The baseline review of air quality in section 26.6.2 provides a clear indication that the air quality in the area of the project is good with areas of air quality concern and monitoring confined to urban areas. Air quality is managed and driven by EU, UK and local legislation and policies. The UK's national AQS and standards are enacted locally through management actions at a local authority level including a Local Air Quality Management framework, as detailed in section 26.2.1. There is a policy trend towards the achievement and maintenance of good air quality across the UK, which is reflected in the local planning policies detailed in Table 26.3. Predicted emissions to air from changes in land use, new developments and associated vehicles are assessed as part of the development planning and consent process. In addition to planning controls there is a clear trend for emissions to air from vehicle, commercial and industrial sources to be driven down in compliance with stricter emissions legislation. Consequently, in relation to the project and its immediate receiving environment it is reasonable to predict a general steady baseline of good air quality would be maintained.

26.7 Potential Impacts

114. The EIA has been undertaken for the following two alternative scenarios therefore an assessment of potential impacts has been undertaken for each scenario:

- **Scenario 1** – Norfolk Vanguard proceeds to construction and installs ducts and other shared enabling works for Norfolk Boreas.

- **Scenario 2** – Norfolk Vanguard does not proceed to construction and Norfolk Boreas proceeds alone. Norfolk Boreas undertakes all works required as an independent project.

115. Where the assessment of the impact is different for Scenario 1 and Scenario 2 a separate assessment is presented under each impact heading. Where this is relevant, Scenario 2 is presented first as it would generally result in the more significant impacts.

26.7.1 Embedded Mitigation

116. Norfolk Boreas Limited has committed to a number of techniques and engineering designs/modifications inherent as part of the project, during the pre-application phase, in order to avoid a number of impacts or reduce impacts as far as possible. Embedding mitigation into the project design is a type of primary mitigation and is an inherent aspect of the EIA process.

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

118. The following section outlines the key embedded mitigation measures relevant for this assessment. These measures are shown in Table 26.28.

Table 26.28 Embedded mitigation

Parameter	Mitigation measures embedded into the project design	Notes
Project Wide		
Commitment to HVDC technology	Commitment to HVDC technology minimises environmental impacts through the following design considerations; • HVDC requires fewer cables than the HVAC solution. During the duct installation phase under Scenario 2 this reduces the cable route working width for Norfolk Boreas to 35m from the previously identified worst case of 50m. As a result, the overall footprint of the onshore cable route required for the duct installation phase is reduced from approx. 300ha to 210ha; • The width of permanent cable easement is also reduced from 25m to 13m; • Removes the requirement for a cable relay station as permanent above ground infrastructure; • Reduces the maximum duration of the cable pull phase from three years down to two years;	Norfolk Boreas Limited has reviewed consultation received and in light of the feedback, has made a number of decisions in relation to the project design. One of these decisions is to deploy HVDC technology as the export system.

Parameter	Mitigation measures embedded into the project design	Notes
	• Reduces the total number of jointing pits for Norfolk Boreas from 450 to 150; and • Reduces the number of drills needed at trenchless crossings (including landfall).	
Site selection	The project has undergone an extensive site selection process which has involved incorporating environmental considerations in collaboration with the engineering design requirements. Considerations include (but are not limited to) adhering to the Horlock Rules (for explanation see Chapter 4 Site Selection and Alternatives) for the onshore project substations and National Grid substation extension and associated infrastructure, a preference for the shortest route length (where practical) and developing construction methodologies to minimise potential impacts. Key design principles from the outset were followed (wherever practical) and further refined during the EIA process, including; • Avoiding proximity to residential dwellings; • Avoiding proximity to historic buildings; • Avoiding designated sites; • Minimising impacts to local residents in relation to access to services and road usage, including footpath closures; • Utilising open agricultural land, therefore reducing road carriageway works; • Minimising requirement for complex crossing arrangements, e.g. road, river and rail crossings; • Avoiding areas of important habitat, trees, ponds and agricultural ditches; • Installing cables in flat terrain maintaining a straight route where possible for ease of pulling cables through ducts; • Avoiding other services (e.g. gas pipelines) but aiming to cross at close to right angles where crossings are required; • Minimising the number of hedgerow crossings, utilising existing gaps in field boundaries; • Avoiding rendering parcels of agricultural land inaccessible; and • Utilising and upgrading existing accesses where possible to avoid impacting undisturbed ground.	Constraints mapping and sensitive site selection to avoid a number of impacts or to reduce impacts as far as possible, is a type of primary mitigation and is an inherent aspect of the EIA process. Norfolk Boreas Limited has reviewed consultation received to inform the site selection process (including local communities, landowners and regulators) and in response to feedback, has made a number of decisions in relation to the siting of project infrastructure. The site selection process is set out in Chapter 4 Site Selection and Assessment of Alternatives.
Long HDD at Landfall	Use of long HDD at landfall to avoid restrictions or closures to Happisburgh beach and retain access to the beach for the public during construction. Norfolk Boreas Limited have also committed to not using the beach car park at Happisburgh South.	Norfolk Boreas Limited has reviewed consultation received and in light of feedback, has made a number of decisions in relation to the project design. One of those decisions is to use long HDD at landfall.

Parameter	Mitigation measures embedded into the project design	Notes
Scenario 1		
Strategic approach to delivering Norfolk Boreas and Norfolk Vanguard	Under Scenario 1, onshore ducts will be installed for both projects at the same time as part of the Norfolk Vanguard construction works. This would allow the main civil works for the cable route to be completed in one construction period and in advance of cable delivery, preventing the requirement to reopen the land in order to minimise disruption. Onshore cables would then be pulled through the pre-installed ducts in a phased approach at later stages. In accordance with the Horlock Rules, the co-location of Norfolk Boreas and Norfolk Vanguard onshore project substations will keep these developments contained within a localised area and, in so doing, will contain the extent of potential impacts.	The strategic approach to delivering Norfolk Boreas and Norfolk Vanguard has been a project commitment from the outset of each project.
Scenario 2		
Duct installation strategy	Under Scenario 2, the onshore cable duct installation strategy is proposed to be conducted in a sectionalised approach in order to minimise impacts. Construction teams would work on a short length (approximately 150m section) and once the cable ducts have been installed, the section would be back filled and the top soil replaced before moving onto the next section. This would minimise the amount of land being worked on at any one time and also minimise overall disruption.	This has been a very early project commitment. Chapter 5 Project Description provides a detailed description of the process.
Trenchless crossings	Commitment to trenchless crossing techniques to minimise impacts to the following specific features; • Wendling Carr County Wildlife Site; • Little Wood County Wildlife Site; • Land South of Dillington Carr County Wildlife Site; • Kerdiston proposed County Wildlife Site; • Marriott's Way County Wildlife Site / Public Right of Way; • Paston Way and Knapton Cutting County Wildlife Site; • Norfolk Coast Path; • Witton Hall Plantation along Old Hall Road; • King's Beck; • River Wensum; • River Bure; • Wendling Beck; • Wendling Carr; • North Walsham and Dilham Canal; • Network Rail line at North Walsham that runs from Norwich to Cromer; • Mid-Norfolk Railway line at Dereham that runs from Wymondham to North Elmham; and • Trunk Roads including A47, A140, A149 and • Crossing with Hornsea Project Three (if required).	A commitment to a number of trenchless crossings at certain sensitive locations was identified at the outset. However, Norfolk Boreas Limited has committed to certain additional trenchless crossings as a direct response to stakeholder requests.

26.7.2 Monitoring

119. Post-consent, the development of the detailed design for the project and the CoCP (DCO Requirement 20) will refine the worst-case impacts assessed in this ES. It is recognised that monitoring is an important element in the management and verification of the actual project impacts. The requirement for, and appropriate design and scope of, monitoring will be agreed with the appropriate stakeholders and included within the final CoCP commitments prior to construction works commencing. An outline CoCP (document reference 8.1) has been prepared and submitted as part of the DCO application.

26.7.3 Worst Case

120. The air quality assessment was based on a 'Rochdale Envelope' approach, whereby the worst case assumptions for a range of parameters were considered. Chapter 5 Project Description sets out the details of the project.

121. This section establishes the worst case assumptions under Scenario 1 and Scenario 2 with respect to air quality. The worst case assumptions include the parameters of the different potential construction options for the project which would result in the greatest potential impact upon the receptors described in section 26.6.4, which is expected to occur at receptors in the vicinity of the onshore project area.

122. The worst case assumptions used in the air quality assessment for Scenario 1 and Scenario 2 are detailed in Table 26.29 and Table 26.30 respectively.

Table 26.29 Worst case assumptions for Scenario 1

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Onshore cable route			
Construction dust and fine particulate matter assessment opposing[2]	Joint pit installation	Assumes 150 at 90m^2 and 2m deep each	Joint pits within 350m of receptors. Concrete bases formed in-situ.
	Maximum number and dimension of link boxes	Assumes 24 at 1.5m x 1.5 if below ground or 1.2m x 0.8m x 1.8m if above ground.	Exact type and locations to be decided during detailed design.

[2] These elements were considered in the determination of the dust emission magnitude, in the area that the most sensitive receptors are present in the vicinity of the onshore project area.

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Construction vehicle exhaust emissions	Maximum development-generated traffic added to the future highest base traffic flows within the construction period	24-hour Annual Average Daily Traffic Flows	Project-generated construction traffic flows were derived using the WCS parameters detailed in Chapter 24 Traffic and Transport for Scenario 1.
Operational air quality impacts	As agreed with the SoS, given the nature of the development, onshore operational air quality impacts have been scoped out of the assessment.		
Decommissioning - dust emissions	Decommissioning activities are not anticipated to exceed the construction phase worst case criteria. The decommissioning phase of the onshore cable route is therefore not considered to represent the worst case scenario with regard to air quality.		
Decommissioning - vehicle exhaust emissions			
Onshore project substation			
Construction	The construction and operational phases of the onshore project substation are not considered to represent the worst case with regard to air quality		
Operation			
Decommissioning	No decision has been made regarding the final decommissioning policy for the onshore project substation, as it is recognised that industry best practice, rules and legislation change over time. However, the onshore project equipment will likely be removed and reused or recycled. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst case, impacts as for the construction phase are assumed.		

Table 26.30 Worst case assumptions for Scenario 2

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Onshore cable route			
Construction dust and fine particulate matter assessment[3]	Maximum working width and length of cable route	35m x 60km	
	Duct installation methodology - trench excavated material	180,000m^3	
	Jointing pit installation	Assumes 150 at 90m^2 and 2m deep each	Joint pits within 350m of receptors. Concrete bases formed in-situ.
	Link boxes	Assumes 24, exact locations to be decided during detailed design. Dimensions 1.5m x 1.5 if below ground or 1.2m x 0.8m x 1.8m if above ground.	
	Mobilisation areas	Assumes 14 at 10,000m^2	Mobilisation areas within 50m of receptors.
	Use of cement during duct installation	Cement-bound sand will be packed around the ducts and then backfilled using the stored subsoil and topsoil.	Cementitious material has a high potential for dust release
Construction vehicle exhaust emissions	Maximum development-generated traffic added to the future highest base traffic flows within the construction period	24-hour Annual Average Daily Traffic Flows	Project-generated construction traffic flows were derived using the worst case parameters detailed in Chapter 24 Traffic and Transport for Scenario 2.
Operational air quality impacts	As agreed with the SoS, given the nature of the development, onshore operational air quality impacts have been scoped out of the assessment.		
Decommissioning - dust emissions	Decommissioning activities are not anticipated to exceed the construction phase worst case criteria. The decommissioning phase of the onshore cable route is therefore not considered to represent the worst case with regard to air quality.		
Decommissioning - vehicle exhaust emissions			

[3] These elements were considered in the determination of the dust emission magnitude, in the area that the most sensitive receptors are present in the vicinity of the onshore project area.

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Onshore project substation			
Construction	The construction and operational phases of the onshore project substation are not considered to represent the worst case with regard to air quality		
Operation			
Decommissioning	No decision has been made regarding the final decommissioning policy for the onshore project substation, as it is recognised that industry best practice, rules and legislation change over time. However, the onshore project equipment will likely be removed and reused or recycled. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst case, impacts as for the construction phase are assumed.		

26.7.4 Potential Impacts during Construction

26.7.4.1 Impact 1: Construction dust and fine particulate matter

26.7.4.1.1 Scenario 1 and Scenario 2

123. A qualitative assessment of construction phase dust and PM_{10} emissions was carried out in accordance with the latest IAQM guidance (IAQM, 2014). Full details of the methodology and dust assessment undertaken are provided in Appendix 26.1.

124. The onshore construction works associated with the project have the potential to impact on local air quality conditions as described below:

- Dust emissions generated by excavation, construction and earthwork activities have the potential to cause nuisance to, and soiling of, sensitive receptors;
- Emissions of exhaust pollutants, especially NO_2 and PM_{10} from construction traffic on the local road network, have the potential to impact upon local air quality at sensitive receptors situated adjacent to the routes utilised by construction vehicles; and
- Emissions of PM_{10} from on-site plant, termed Non-road Mobile Machinery (NRMM) operating within the onshore project area have the potential to impact local air quality at sensitive receptors in close proximity to the works.

125. The assessment consisted of 4 steps (Step 1, Step 2A, Step 2B and Step 2C) as outlined below:

Step 1: Screen the need for a detailed assessment

126. The IAQM guidance states that a Detailed Assessment is required if there are human receptors located within 350m and ecological receptors within 50m of the onshore project area. Human receptors are present within 350m of the onshore project area, therefore a Detailed Assessment was required. There are no ecological sites within

50m of the onshore construction activities, therefore ecological impacts have not been discussed further in relation to construction dust within this assessment.

Step 2A: Define the potential dust emission magnitude

127. The IAQM guidance recommends that the dust emission magnitude is determined for demolition, earthworks, construction and trackout.

128. National Grid overhead line modifications would take place as part of Scenario 2 only. Due to the nature of the structures, these works are not expected to generate dust and are therefore not considered in the construction phase dust assessment. As there would be no demolition of any structures (other than the decommissioning of an overhead line tower as part of the overhead line modification) undertaken as part of the construction of the project, it has not been considered in the assessment.

129. The potential dust emission magnitude for the onshore project area under both Scenario 2 and Scenario 1 was determined using the criteria detailed in Table 3.1 of Appendix 26.1. The dust emission magnitudes were determined from the worst case assumptions identified in Table 26.29 and Table 26.30Table 26.30 and detailed in Table 26.31.

130. The onshore cable route from landfall to the onshore project substation was assessed and the WCS was identified based on the number of receptors within 350m from the site boundaries and 50m from the construction vehicle routes, up to 500m from the cable route. North Walsham, approximately 11km from landfall at Happisburgh, was identified as the area with the most receptors within 350m of the onshore project area. A worst case assessment was carried out which assumed that receptors were within 350m of a mobilisation area for Scenario 2 only, and the onshore cable route which would include jointing pits and link boxes for both Scenario 2 and Scenario 1 (see Chapter 24 Traffic and Transport). Therefore, this area provides the WCS for both Scenario 2 and Scenario 1. The assessment for trackout impact also considered receptors within 50m of the access road up to 500m from the site boundary.

Table 26.31 Defined dust emission magnitudes associated for each construction activity for the onshore project area

Construction Activity	Dust Emission Magnitude Assessment	
	Scenario 2	Scenario 1
Earthworks	The mobilisation areas have a footprint of 100m x 100m. Earthworks within the onshore cable route will comprise removal and storage of topsoil (35m x 150m area per section), followed by excavation and reinstatement of up to 2	Earthworks will comprise excavation of joint pits (90m^2) and link boxes, and the running track will be reinstalled (6m wide) in some areas around North Walsham where existing access is not sufficient. The total earthworks area is 90m^2, and it is anticipated that there would be less than 5

Construction Activity	Dust Emission Magnitude Assessment Scenario 2	Scenario 1
	trenches (each 1m wide x 1.5m deep and up to 150m long per work front). The total earthworks area is greater than 10,000m^2. The dust emission magnitude is therefore large.	heavy earth moving vehicles active at any one time on the site. The dust emission magnitude is therefore small.
Construction	There are not anticipated to be any buildings built within the mobilisation areas (office, welfare etc. will be prefabricated), however it has been assumed that cement-bound sand will be used to line the cable trench and pack around the ducts then backfilled using the stored subsoil and topsoil. The dust emission magnitude is therefore medium.	There is not anticipated to be any significant construction activities associated with the onshore cable route associated with Scenario 1. The dust emission magnitude is therefore small.
Trackout	There will be more than 50 outward daily HGV movements from the mobilisation areas during the construction phase. The dust emission magnitude is therefore large.	There will be between 10 and 50 outward daily HGV movements from the individual cable pulling areas. The dust emission magnitude is therefore medium.

Step 2B: Define the sensitivity of the area

131. The sensitivity of receptors to dust soiling and impacts on human health was determined using the criteria in Table 3.2 of Appendix 26.1. Figure 26.6 details the distance bands from the site boundary used in determining the sensitivity of the area. The sensitivity of the area is defined as:

- Sensitivity of receptors to dust soiling
  - Earthworks and Construction: There are between 10 and 100 receptors within 50m of the mobilisation areas and onshore cable route. The sensitivity is therefore medium; and
  - Trackout: There are between 10 and 100 receptors within 50m of roads used by construction vehicles up to 500m from the site boundary. The sensitivity is therefore medium.
- Sensitivity of receptors to human health effects of PM_{10}
  - Earthworks and Construction: The highest annual mean background PM_{10} concentration across the study area is less than 20µg.m^{-3} and there are between 10 and 100 receptors within 50m from the mobilisation areas and onshore cable route. The sensitivity is therefore low; and

- Trackout: There are between 10 and 100 receptors within 50m of roads used by construction vehicles, up to 500m from the site. The sensitivity is therefore low.

132. The sensitivity of receptors to dust soiling and human health impacts under both Scenario 2 and Scenario 1 for each activity is summarised in Table 26.32.

Table 26.32 Sensitivity of the area to each activity under Scenario 2 and Scenario 1

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium
Human Health	Low	Low	Low

Step 2C: Define the risk of impacts

133. The dust and PM_{10} emission magnitude and sensitivity of the area are combined and the risk of impacts determined using Tables 3.5 to 3.7 in Appendix 26.1. The risks for dust soiling and human health are shown in Table 26.33 for Scenario 2 and Table 26.34 for Scenario 1.

Table 26.33 Risk of dust impacts – Scenario 2

Potential Impact	Dust Risk		
	Earthworks	Construction	Trackout
Dust Soiling	Medium Risk	Medium Risk	Medium Risk
Human Health	Low Risk	Low Risk	Low Risk

Table 26.34 Risk of dust impacts – Scenario 1

Potential Impact	Dust Risk		
	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Low Risk	Low Risk
Human Health	Negligible Risk	Negligible Risk	Low Risk

134. Step 3 of the IAQM guidance identifies the appropriate good practice mitigation measures required based on the findings of Step 2 of the assessment methodology. Step 2 of the dust assessment determined that the greatest risk of impacts was 'medium risk' under Scenario 2, and 'low risk' under Scenario 1 without the implementation of mitigation measures.

135. Recommended mitigation measures are listed in the IAQM guidance document according to the 'risk' of impacts associated with the release of dust and PM_{10} from construction activities. Recommended mitigation measures include minimising the production and transmission of dust from construction activities, and the requirement to carry out visual on-site and off-site inspections of dust deposition levels.

136. An outline CoCP has been prepared and submitted as part of the DCO application (document reference 8.1). The outline CoCP sets out management measures for all onshore construction works associated with the project and includes measures to suppress the generation of dust.

137. In advance of construction commencing a final CoCP will be submitted for each agreed stage of the works detailing appropriate air quality management measures to be employed. The measures included will be agreed with the local authority prior to construction commencing. With the implementation of the appropriate mitigation measures, in addition to embedded mitigation measures, the residual impacts from construction are expected to be **not significant**, in accordance with IAQM guidance.

26.7.4.2 Impact 2: Construction vehicle exhaust emissions

26.7.4.2.1 Scenario 2

Human Receptors

138. The 24-hour AADT flows and HGV percentages used in the air quality assessment for Scenario 2 are detailed in Appendix 26.2.

139. Predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for the 2024 year of peak construction 'with project' scenario are detailed in Table 26.35 to Table 26.37. Concentrations for the 'without project' assessment and the predicted change in NO_2, PM_{10} and $PM_{2.5}$ concentrations, as a result of the proposed project, are also shown for comparison purposes.

Table 26.35 Scenario 2 annual mean NO_2 results at sensitive human receptor locations

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean NO_2 concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
Breckland	R3	17.16	17.66	0.50	1	Negligible
	R4	20.10	20.84	0.74	2	Negligible
	R9	12.29	12.71	0.42	1	Negligible
	R10	8.60	8.82	0.22	1	Negligible
	R11	9.39	9.80	0.41	1	Negligible
	R12	9.16	9.46	0.30	1	Negligible
	R15	9.98	10.17	0.19	0	Negligible
	R16	19.48	20.30	0.82	2	Negligible
	R22	15.69	15.93	0.24	1	Negligible
	R80	8.21	8.37	0.16	0	Negligible
	R81	8.76	8.98	0.22	1	Negligible
	R82	9.22	9.49	0.27	1	Negligible
	R83	10.62	10.87	0.25	1	Negligible
	R87	9.80	10.08	0.28	1	Negligible

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean NO_2 concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
Broadland	R17	10.28	10.80	0.52	1	Negligible
	R18	9.37	9.62	0.25	1	Negligible
	R19	13.43	13.75	0.32	1	Negligible
	R20	16.99	17.81	0.82	2	Negligible
	R21	11.93	12.21	0.28	1	Negligible
	R35	26.20	26.68	0.48	1	Negligible
	R36	27.86	28.39	0.53	1	Negligible
	R42	14.64	14.88	0.24	1	Negligible
	R43	12.11	12.26	0.15	0	Negligible
	R49	16.60	17.15	0.55	1	Negligible
	R69	14.55	14.83	0.28	1	Negligible
	R70	22.83	23.40	0.57	1	Negligible
	R71	34.06	34.78	0.72	2	Slight adverse
	R75	12.93	13.38	0.45	1	Negligible
	R76	17.61	18.44	0.83	2	Negligible
	R77	12.86	13.15	0.29	1	Negligible
	R79	11.19	11.59	0.40	1	Negligible
	R85	12.97	13.27	0.30	1	Negligible
	R86	19.76	20.61	0.85	2	Negligible
	R88	8.92	9.20	0.28	1	Negligible
Great Yarmouth	R33	19.74	20.50	0.76	2	Negligible
	R34	25.38	26.14	0.76	2	Negligible
	R37	17.37	17.78	0.41	1	Negligible
	R38	21.87	22.27	0.40	1	Negligible
	R39	22.79	23.37	0.58	1	Negligible
	R40	11.88	12.03	0.15	0	Negligible
	R41	14.14	14.41	0.27	1	Negligible
	R67	17.62	18.24	0.62	2	Negligible
	R68	14.93	15.74	0.81	2	Negligible
	R72	26.25	27.31	1.06	3	Negligible
King's Lynn	R1	24.92	25.57	0.65	2	Negligible
	R2	16.86	17.25	0.39	1	Negligible
North Norfolk	R5	11.98	12.59	0.61	2	Negligible
	R6	12.19	12.83	0.64	2	Negligible
	R7	14.32	15.39	1.07	3	Negligible
	R8	12.14	12.88	0.74	2	Negligible
	R13	12.68	13.12	0.44	1	Negligible
	R14	14.73	15.80	1.07	3	Negligible
	R44	13.70	14.49	0.79	2	Negligible
	R45	14.42	15.32	0.90	2	Negligible
	R46	10.51	11.05	0.54	1	Negligible
	R47	13.03	14.02	0.99	2	Negligible
	R48	13.77	14.61	0.84	2	Negligible
	R50	13.62	14.16	0.54	1	Negligible
	R51	8.65	8.73	0.08	0	Negligible
	R52	13.54	14.42	0.88	2	Negligible
	R53	12.34	13.03	0.69	2	Negligible
	R54	11.86	12.14	0.28	1	Negligible

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean NO_2 concentrations (µg.m^{-3})				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
	R55	10.64	10.80	0.16	0	Negligible
	R56	9.61	9.88	0.27	1	Negligible
	R57	10.40	10.89	0.49	1	Negligible
	R58	13.76	14.47	0.71	2	Negligible
	R59	10.38	10.96	0.58	1	Negligible
	R60	12.44	12.77	0.33	1	Negligible
	R61	11.83	12.06	0.23	1	Negligible
	R62	14.30	14.79	0.49	1	Negligible
	R63	13.49	14.08	0.59	1	Negligible
	R64	11.25	11.52	0.27	1	Negligible
	R65	14.37	14.70	0.33	1	Negligible
	R66	14.68	15.01	0.33	1	Negligible
	R73	12.09	12.62	0.53	1	Negligible
	R74	9.24	9.46	0.22	1	Negligible
	R78	10.06	10.31	0.25	1	Negligible
	R84	12.76	13.30	0.54	1	Negligible
South Norfolk	R23	14.73	14.94	0.21	1	Negligible
	R24	16.04	16.10	0.06	0	Negligible
	R25	17.35	17.43	0.08	0	Negligible
	R26	14.02	14.42	0.40	1	Negligible
	R27	17.80	18.53	0.73	2	Negligible
	R89	22.16	22.27	0.11	0	Negligible
Waveney	R28	13.30	13.68	0.38	1	Negligible
	R29	15.73	16.30	0.57	1	Negligible
	R30	18.56	19.98	1.42	4	Negligible
	R31	13.58	14.20	0.62	2	Negligible
	R32	21.28	22.44	1.16	3	Negligible

Table 26.36 Scenario 2 annual mean PM_{10} results at sensitive human receptor locations

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean PM_{10} concentrations (µg.m^{-3})				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
Breckland	R3	14.23	14.29	0.06	0	Negligible
	R4	15.68	15.77	0.08	0	Negligible
	R9	15.61	15.66	0.04	0	Negligible
	R10	12.99	13.01	0.02	0	Negligible
	R11	13.53	13.57	0.04	0	Negligible
	R12	14.61	14.63	0.02	0	Negligible
	R15	15.15	15.17	0.02	0	Negligible
	R16	16.16	16.26	0.10	0	Negligible
	R22	13.18	13.21	0.03	0	Negligible
	R80	13.77	13.79	0.02	0	Negligible
	R81	14.50	14.52	0.02	0	Negligible
	R82	15.82	15.85	0.03	0	Negligible

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean PM_{10} concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
	R83	15.27	15.29	0.02	0	Negligible
	R87	15.00	15.02	0.03	0	Negligible
Broadland	R17	13.85	13.90	0.05	0	Negligible
	R18	13.61	13.63	0.02	0	Negligible
	R19	14.44	14.48	0.04	0	Negligible
	R20	15.21	15.30	0.09	0	Negligible
	R21	15.46	15.49	0.03	0	Negligible
	R35	14.66	14.72	0.06	0	Negligible
	R36	17.22	17.29	0.07	0	Negligible
	R42	14.19	14.22	0.03	0	Negligible
	R43	13.23	13.25	0.02	0	Negligible
	R49	15.03	15.08	0.05	0	Negligible
	R69	15.17	15.20	0.03	0	Negligible
	R70	14.98	15.05	0.07	0	Negligible
	R71	17.19	17.28	0.10	0	Negligible
	R75	13.79	13.84	0.04	0	Negligible
	R76	15.50	15.59	0.08	0	Negligible
	R77	14.51	14.54	0.03	0	Negligible
	R79	14.80	14.83	0.04	0	Negligible
	R85	15.22	15.25	0.03	0	Negligible
	R86	15.59	15.68	0.09	0	Negligible
	R88	16.46	16.48	0.03	0	Negligible
Great Yarmouth	R33	15.90	15.97	0.07	0	Negligible
	R34	15.36	15.45	0.09	0	Negligible
	R37	13.92	13.96	0.05	0	Negligible
	R38	18.29	18.32	0.03	0	Negligible
	R39	13.84	13.89	0.05	0	Negligible
	R40	13.11	13.12	0.02	0	Negligible
	R41	13.42	13.45	0.03	0	Negligible
	R67	15.49	15.54	0.05	0	Negligible
	R68	14.49	14.55	0.06	0	Negligible
	R72	14.40	14.49	0.09	0	Negligible
King's Lynn	R1	15.86	15.93	0.08	0	Negligible
	R2	14.50	14.55	0.05	0	Negligible
North Norfolk	R5	15.04	15.11	0.06	0	Negligible
	R6	14.86	14.93	0.07	0	Negligible
	R7	15.34	15.42	0.08	0	Negligible
	R8	14.22	14.28	0.06	0	Negligible
	R13	14.91	14.94	0.03	0	Negligible
	R14	15.42	15.50	0.08	0	Negligible
	R44	18.00	18.06	0.06	0	Negligible
	R45	14.60	14.67	0.07	0	Negligible
	R46	13.61	13.66	0.05	0	Negligible
	R47	15.86	15.95	0.08	0	Negligible
	R48	14.40	14.45	0.06	0	Negligible
	R50	15.06	15.09	0.03	0	Negligible
	R51	13.23	13.24	0.01	0	Negligible
	R52	16.17	16.23	0.07	0	Negligible

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean PM_{10} concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
	R53	14.84	14.89	0.05	0	Negligible
	R54	13.86	13.89	0.03	0	Negligible
	R55	13.80	13.81	0.01	0	Negligible
	R56	13.76	13.78	0.02	0	Negligible
	R57	14.41	14.44	0.04	0	Negligible
	R58	14.68	14.73	0.05	0	Negligible
	R59	14.78	14.84	0.06	0	Negligible
	R60	13.74	13.78	0.03	0	Negligible
	R61	13.86	13.89	0.02	0	Negligible
	R62	14.17	14.23	0.05	0	Negligible
	R63	15.17	15.22	0.04	0	Negligible
	R64	14.74	14.76	0.02	0	Negligible
	R65	13.48	13.51	0.03	0	Negligible
	R66	12.43	12.46	0.03	0	Negligible
	R73	13.75	13.80	0.04	0	Negligible
	R74	13.53	13.55	0.02	0	Negligible
	R78	15.30	15.32	0.02	0	Negligible
	R84	15.12	15.17	0.05	0	Negligible
South Norfolk	R23	13.85	13.87	0.02	0	Negligible
	R24	14.08	14.09	0.01	0	Negligible
	R25	14.50	14.51	0.01	0	Negligible
	R26	14.77	14.81	0.04	0	Negligible
	R27	16.19	16.26	0.07	0	Negligible
	R89	14.09	14.10	0.01	0	Negligible
Waveney	R28	14.46	14.49	0.03	0	Negligible
	R29	13.94	13.99	0.04	0	Negligible
	R30	14.60	14.71	0.11	0	Negligible
	R31	14.20	14.24	0.05	0	Negligible
	R32	15.25	15.36	0.11	0	Negligible

Table 26.37 Scenario 2 annual mean $PM_{2.5}$ results at sensitive human receptor locations

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean $PM_{2.5}$ concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
Breckland	R3	9.24	9.28	0.04	0	Negligible
	R4	9.97	10.02	0.05	0	Negligible
	R9	9.81	9.84	0.03	0	Negligible
	R10	8.60	8.61	0.01	0	Negligible
	R11	8.88	8.90	0.02	0	Negligible
	R12	9.48	9.49	0.01	0	Negligible
	R15	10.08	10.09	0.01	0	Negligible
	R16	10.67	10.73	0.06	0	Negligible
	R22	8.82	8.83	0.01	0	Negligible
	R80	8.99	9.00	0.01	0	Negligible

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean $PM_{2.5}$ concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
	R81	9.54	9.55	0.01	0	Negligible
	R82	10.16	10.18	0.02	0	Negligible
	R83	9.75	9.76	0.01	0	Negligible
	R87	10.51	10.52	0.01	0	Negligible
Broadland	R17	8.85	8.88	0.03	0	Negligible
	R18	8.89	8.91	0.02	0	Negligible
	R19	9.29	9.31	0.02	0	Negligible
	R20	9.94	9.99	0.05	0	Negligible
	R21	9.92	9.94	0.02	0	Negligible
	R35	10.04	10.08	0.04	0	Negligible
	R36	12.36	12.40	0.04	0	Negligible
	R42	9.42	9.44	0.02	0	Negligible
	R43	8.86	8.87	0.01	0	Negligible
	R49	9.50	9.53	0.03	0	Negligible
	R69	9.97	9.99	0.02	0	Negligible
	R70	9.96	10.00	0.04	0	Negligible
	R71	11.39	11.44	0.05	0	Negligible
	R75	8.38	8.40	0.02	0	Negligible
	R76	10.14	10.19	0.05	0	Negligible
	R77	9.34	9.36	0.02	0	Negligible
	R79	9.86	9.88	0.02	0	Negligible
	R85	10.00	10.02	0.02	0	Negligible
	R86	10.95	11.00	0.05	0	Negligible
	R88	12.22	12.24	0.02	0	Negligible
Great Yarmouth	R33	10.26	10.30	0.04	0	Negligible
	R34	9.78	9.83	0.05	0	Negligible
	R37	9.03	9.06	0.03	0	Negligible
	R38	13.65	13.67	0.02	0	Negligible
	R39	9.43	9.46	0.03	0	Negligible
	R40	8.80	8.81	0.01	0	Negligible
	R41	9.12	9.14	0.02	0	Negligible
	R67	10.16	10.19	0.03	0	Negligible
	R68	9.39	9.43	0.04	0	Negligible
	R72	9.53	9.58	0.05	0	Negligible
King's Lynn	R1	9.93	9.98	0.05	0	Negligible
	R2	9.34	9.37	0.03	0	Negligible
North Norfolk	R5	9.58	9.62	0.04	0	Negligible
	R6	9.44	9.48	0.04	0	Negligible
	R7	9.95	10.00	0.05	0	Negligible
	R8	9.26	9.29	0.03	0	Negligible
	R13	9.55	9.57	0.02	0	Negligible
	R14	10.00	10.05	0.05	0	Negligible
	R44	13.49	13.52	0.03	0	Negligible
	R45	9.58	9.62	0.04	0	Negligible
	R46	8.90	8.93	0.03	0	Negligible
	R47	10.41	10.46	0.05	0	Negligible
	R48	9.17	9.20	0.03	0	Negligible
	R50	9.53	9.54	0.01	0	Negligible

Local Authority	Receptor ID	Scenario 2 – 2024 annual mean $PM_{2.5}$ concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2	Change	Change as % of objective	Impact descriptor
	R51	8.59	8.60	0.01	0	Negligible
	R52	9.94	9.98	0.04	0	Negligible
	R53	9.39	9.42	0.03	0	Negligible
	R54	8.98	9.00	0.02	0	Negligible
	R55	8.94	8.95	0.01	0	Negligible
	R56	9.09	9.11	0.02	0	Negligible
	R57	9.50	9.53	0.03	0	Negligible
	R58	9.66	9.69	0.03	0	Negligible
	R59	9.59	9.62	0.03	0	Negligible
	R60	9.02	9.04	0.02	0	Negligible
	R61	9.09	9.10	0.01	0	Negligible
	R62	9.27	9.30	0.03	0	Negligible
	R63	10.74	10.76	0.02	0	Negligible
	R64	9.81	9.83	0.02	0	Negligible
	R65	8.98	9.00	0.02	0	Negligible
	R66	8.43	8.45	0.02	0	Negligible
	R73	8.03	8.06	0.03	0	Negligible
	R74	8.21	8.22	0.01	0	Negligible
	R78	10.22	10.23	0.01	0	Negligible
	R84	9.66	9.69	0.03	0	Negligible
South Norfolk	R23	9.10	9.11	0.01	0	Negligible
	R24	9.23	9.23	0.00	0	Negligible
	R25	9.46	9.47	0.01	0	Negligible
	R26	9.80	9.82	0.02	0	Negligible
	R27	10.48	10.52	0.04	0	Negligible
	R89	9.79	9.80	0.01	0	Negligible
Waveney	R28	9.37	9.38	0.01	0	Negligible
	R29	9.02	9.04	0.02	0	Negligible
	R30	9.64	9.71	0.07	0	Negligible
	R31	9.22	9.25	0.03	0	Negligible
	R32	10.02	10.08	0.06	0	Negligible

140. The results of the construction phase road traffic emissions assessment indicate that annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted to be below the respective Air Quality Objectives in the year of peak construction (2024) under Scenario 2 at all receptors, both 'without' and 'with' the project in place.

141. The change in NO_2 concentrations was 4% or less at all receptors; this corresponded to a 'negligible' impact due to low total NO_2 concentrations, in accordance with IAQM and EPUK guidance (IAQM and EPUK, 2017). Receptor R71 was predicted to experience a 2% change in concentrations, which corresponded to a 'slight adverse' impact as the total concentration is above $30\mu g.m^{-3}$. This is because this receptor is located close to the Broadland Northway, which has relatively high traffic flows.

142. All predicted NO_2 concentrations were well below 60µg.m^{-3} and therefore, in accordance with Defra guidance in LAQM.TG (16) (Defra ,2016), the 1-hour mean objective is unlikely to be exceeded (see Table 26.1). Based on the calculation provided by Defra, as detailed in section 26.4.1.2.10, the short-term PM_{10} objective was predicted to be met at all modelled locations (objective being less than 35 exceedances of the daily mean objective of 50µg.m^{-3}). Using the Defra calculation, there was no change in the number of days exceeding the daily mean objective between the 'without' and 'with' project assessments.

143. This assessment concludes that project-generated construction traffic impacts under Scenario 2 upon local air quality are not significant based upon:

- A predicted negligible impact at all receptor locations except one, which was predicted to experience a 'slight adverse' impact;
- Predicted pollutant concentrations were below the relevant Air Quality Objectives at all considered receptor locations;
- Project-generated construction traffic was not predicted to cause a breach of any of the Air Quality Objectives at any identified sensitive receptor location; and
- A conservative approach to the assessment was taken, with the use of 2017 emission factors for predicted 2024 levels, background concentrations and NO_x to NO_2 conversion rates in the future year assessment scenarios.

Ecological receptors

144. The results of the assessment of nutrient nitrogen deposition on designated ecological sites (as shown in Figure 26.5) are detailed in Table 26.38.

Table 26.38 Scenario 2 nutrient nitrogen deposition results

Designated ecological site	Transect ID	Nutrient nitrogen deposition (kgN.ha.y^{-1})		Change (kgN.ha.y^{-1})	Change as % of lowest CL
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2		
Felbrigg Woods SSSI	T1-1	0.55	0.67	0.12	1
	T1-2	0.18	0.21	0.03	0
	T1-3	0.11	0.13	0.02	0
	T1-4	0.09	0.10	0.01	0
	T1-5	0.07	0.08	0.01	0
	T1-6	0.07	0.08	0.01	0
Broadland SPA	T2-1	0.06	0.07	0.01	0
	T2-2	0.05	0.06	0.01	0
	T2-3	0.05	0.06	0.01	0

Designated ecological site	Transect ID	Nutrient nitrogen deposition (kgN.ha.y^{-1})		Change (kgN.ha.y^{-1})	Change as % of lowest CL
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2		
The Broads SAC	T3-1	0.35	0.39	0.04	0
	T3-2	0.09	0.10	0.01	0
	T3-3	0.07	0.07	0.00	0
	T3-4	0.06	0.06	0.00	0
	T3-5	0.05	0.06	0.01	0
	T4-1	1.41	1.59	0.18	1
	T4-2	0.21	0.24	0.03	0
	T4-3	0.13	0.15	0.02	0
	T4-4	0.10	0.12	0.02	0
	T4-5	0.09	0.10	0.01	0
Breydon Water SSSI	T5-1	0.52	0.55	0.03	0
	T5-2	0.24	0.26	0.02	0
	T5-3	0.17	0.18	0.01	0
	T5-4	0.14	0.15	0.01	0
	T5-5	0.13	0.14	0.01	0
	T6-1	2.78	2.97	0.19	1
	T6-2	0.42	0.45	0.03	0
	T6-3	0.26	0.28	0.02	0
	T6-4	0.20	0.21	0.01	0
	T6-5	0.17	0.18	0.01	0
Broadland SPA	T7-1	0.18	0.20	0.02	0
	T7-2	0.11	0.12	0.01	0
	T7-3	0.08	0.08	0.00	0
	T7-4	0.06	0.07	0.01	0
	T8-1	1.83	1.94	0.11	1
	T8-2	0.29	0.31	0.02	0
	T8-3	0.18	0.19	0.01	0
	T8-4	0.14	0.15	0.01	0
	T8-5	0.12	0.13	0.01	0
Cawston and Marsham Levels SSSI	T9-1	0.15	0.16	0.01	0
	T9-2	0.14	0.15	0.01	0
Buxton Heath SSSI	T10-1	0.31	0.33	0.02	0
	T10-2	0.19	0.20	0.01	0
	T10-3	0.14	0.15	0.01	0
	T10-4	0.12	0.13	0.01	0
Holt Lowes SSSI	T11-1	0.37	0.43	0.06	1
	T11-2	0.10	0.11	0.01	0
	T11-3	0.07	0.08	0.01	0
	T11-4	0.05	0.06	0.01	0
	T11-5	0.05	0.05	0.00	0
Foxley Wood SSSI	T12-1	0.05	0.05	0.00	0
	T12-2	0.05	0.05	0.00	0
East Winch Common SSSI	T13-1	1.24	1.30	0.06	1
	T13-2	0.20	0.21	0.01	0
	T13-3	0.11	0.12	0.01	0
	T13-4	0.08	0.08	0.00	0
	T13-5	0.06	0.06	0.00	0

Designated ecological site	Transect ID	Nutrient nitrogen deposition (kgN.ha.y^{-1})		Change (kgN.ha.y^{-1})	Change as % of lowest CL
		Without Norfolk Boreas Scenario 2	With Norfolk Boreas Scenario 2		
Holly Farm Meadow SSSI	T14-1	1.61	1.72	0.11	1
	T14-2	0.49	0.52	0.03	0
	T14-3	0.31	0.33	0.02	0
	T14-4	0.23	0.24	0.01	0
	T14-5	0.18	0.19	0.01	0
Potter and Scarning Fens, East Dereham SSSI	T15-1	2.28	2.43	0.15	1
	T15-2	0.31	0.33	0.02	0
	T15-3	0.16	0.17	0.01	0
	T15-4	0.11	0.12	0.01	0
	T15-5	0.09	0.09	0.00	0
Beetley and Hoe Meadows SSSI	T16-1	0.35	0.38	0.03	0
	T16-2	0.09	0.10	0.01	0
	T16-3	0.06	0.07	0.01	0
	T16-4	0.05	0.05	0.00	0
	T16-5	0.04	0.05	0.01	0
River Wensum SSSI	T17-1	1.62	1.78	0.16	1
	T17-2	0.32	0.35	0.03	0
	T17-3	0.21	0.23	0.02	0
	T17-4	0.16	0.17	0.01	0
	T17-5	0.13	0.14	0.01	0
	T18-1	1.04	1.15	0.11	1
	T18-2	0.17	0.18	0.01	0
	T18-3	0.10	0.11	0.01	0
	T18-4	0.08	0.09	0.01	0
	T18-5	0.07	0.08	0.01	0

145. As detailed in Table 26.38, increases in nutrient nitrogen deposition under Scenario 2 were 1% or below the relevant CL at all of the designated ecological sites, and are therefore considered to be not significant, in accordance with Environment Agency guidance (Environment Agency, 2017).

26.7.4.2.2 Scenario 1

Human Receptors

146. The 24-hour AADT flows and HGV percentages used in the air quality assessment for Scenario 1 are detailed in Appendix 26.2.

147. Predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for the 2027 year of peak construction 'with project' scenario are detailed in Table 26.39 to Table 26.41. Concentrations for the 'without project' assessment and the predicted change in NO_2, PM_{10} and $PM_{2.5}$ concentrations, as a result of the proposed project, are also shown for comparison purposes.

Table 26.39 Scenario 1 Annual mean NO_2 results at sensitive human receptor locations

Local Authority	Receptor ID	Scenario 1 – 2027 annual mean NO_2 concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 1	With Norfolk Boreas Scenario 1	Change	Change as % of objective	Impact descriptor
Breckland	R3	17.54	17.65	0.11	0	Negligible
	R4	20.57	20.74	0.17	0	Negligible
	R12	9.22	9.31	0.09	0	Negligible
	R15	10.04	10.12	0.08	0	Negligible
	R16	19.92	20.22	0.30	1	Negligible
Broadland	R17	10.36	10.65	0.29	1	Negligible
	R18	9.41	9.55	0.14	0	Negligible
	R19	13.60	13.72	0.12	0	Negligible
	R20	17.33	17.62	0.29	1	Negligible
	R21	12.05	12.15	0.10	0	Negligible
	R35	26.57	26.79	0.22	1	Negligible
	R36	28.26	28.51	0.25	1	Negligible
	R49	16.88	17.39	0.51	1	Negligible
	R69	14.88	14.98	0.10	0	Negligible
	R70	23.64	23.92	0.28	1	Negligible
	R71	35.15	35.50	0.35	1	Negligible
Great Yarmouth	R33	20.06	20.44	0.38	1	Negligible
	R34	25.85	26.23	0.38	1	Negligible
	R37	17.64	17.83	0.19	0	Negligible
	R72	26.74	27.21	0.47	1	Negligible
North Norfolk	R5	12.14	12.45	0.31	1	Negligible
	R6	12.36	12.68	0.32	1	Negligible
	R7	14.56	15.04	0.48	1	Negligible
	R8	12.30	12.64	0.34	1	Negligible
	R13	12.80	12.96	0.16	0	Negligible
	R14	15.01	15.41	0.40	1	Negligible
	R44	13.92	14.21	0.29	1	Negligible
	R45	14.67	15.00	0.33	1	Negligible
	R46	10.61	10.79	0.18	0	Negligible
	R47	13.22	13.55	0.33	1	Negligible
	R48	13.99	14.38	0.39	1	Negligible
	R50	13.83	14.34	0.51	1	Negligible
Waveney	R30	18.83	19.55	0.72	2	Negligible
	R31	13.70	14.01	0.31	1	Negligible
	R32	21.76	22.34	0.58	1	Negligible

Table 26.40 Scenario 1 annual mean PM_{10} results at sensitive human receptor locations

Local Authority	Receptor ID	Scenario 1 – 2027 annual mean PM_{10} concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 1	With Norfolk Boreas Scenario 1	Change	Change as % of objective	Impact descriptor
Breckland	R3	14.27	14.28	0.01	0	Negligible
	R4	15.73	15.75	0.02	0	Negligible
	R12	14.61	14.62	0.01	0	Negligible
	R15	15.16	15.17	0.01	0	Negligible
	R16	16.21	16.24	0.04	0	Negligible
Broadland	R17	13.86	13.88	0.03	0	Negligible
	R18	13.61	13.62	0.01	0	Negligible
	R19	14.46	14.47	0.01	0	Negligible
	R20	15.24	15.28	0.03	0	Negligible
	R21	15.47	15.48	0.01	0	Negligible
	R35	14.69	14.72	0.03	0	Negligible
	R36	17.26	17.29	0.03	0	Negligible
	R49	15.06	15.10	0.04	0	Negligible
	R69	15.20	15.21	0.01	0	Negligible
	R70	15.07	15.11	0.03	0	Negligible
	R71	17.32	17.36	0.05	0	Negligible
Great Yarmouth	R33	15.94	15.97	0.04	0	Negligible
	R34	15.41	15.46	0.04	0	Negligible
	R37	13.94	13.96	0.02	0	Negligible
	R72	14.45	14.49	0.04	0	Negligible
North Norfolk	R5	15.06	15.09	0.03	0	Negligible
	R6	14.88	14.91	0.03	0	Negligible
	R7	15.36	15.40	0.04	0	Negligible
	R8	14.24	14.27	0.03	0	Negligible
	R13	14.92	14.93	0.01	0	Negligible
	R14	15.45	15.48	0.03	0	Negligible
	R44	18.03	18.05	0.02	0	Negligible
	R45	14.63	14.65	0.03	0	Negligible
	R46	13.62	13.64	0.01	0	Negligible
	R47	15.88	15.90	0.03	0	Negligible
	R48	14.42	14.44	0.02	0	Negligible
	R50	15.07	15.10	0.02	0	Negligible
Waveney	R30	14.63	14.68	0.06	0	Negligible
	R31	14.21	14.23	0.02	0	Negligible
	R32	15.30	15.36	0.06	0	Negligible

Table 26.41 Scenario 1 annual mean $PM_{2.5}$ results at sensitive human receptor locations

Local Authority	Receptor ID	Scenario 1 – 2027 annual mean $PM_{2.5}$ concentrations ($\mu g.m^{-3}$)				
		Without Norfolk Boreas Scenario 1	With Norfolk Boreas Scenario 1	Change	Change as % of objective	Impact descriptor
Breckland	R3	9.26	9.27	0.01	0	Negligible
	R4	10.00	10.01	0.01	0	Negligible
	R12	9.48	9.48	0.00	0	Negligible
	R15	10.08	10.09	0.00	0	Negligible
	R16	10.70	10.72	0.02	0	Negligible
Broadland	R17	8.85	8.87	0.02	0	Negligible
	R18	8.90	8.90	0.01	0	Negligible
	R19	9.30	9.31	0.01	0	Negligible
	R20	9.96	9.98	0.02	0	Negligible
	R21	9.93	9.93	0.01	0	Negligible
	R35	10.06	10.08	0.02	0	Negligible
	R36	12.38	12.40	0.02	0	Negligible
	R49	9.52	9.54	0.02	0	Negligible
	R69	9.99	10.00	0.01	0	Negligible
	R70	10.01	10.03	0.02	0	Negligible
	R71	11.46	11.49	0.03	0	Negligible
Great Yarmouth	R33	10.28	10.30	0.02	0	Negligible
	R34	9.81	9.84	0.03	0	Negligible
	R37	9.04	9.06	0.01	0	Negligible
	R72	9.56	9.58	0.02	0	Negligible
North Norfolk	R5	9.59	9.61	0.02	0	Negligible
	R6	9.45	9.47	0.02	0	Negligible
	R7	9.96	9.98	0.02	0	Negligible
	R8	9.27	9.28	0.02	0	Negligible
	R13	9.56	9.56	0.01	0	Negligible
	R14	10.01	10.03	0.02	0	Negligible
	R44	13.50	13.51	0.01	0	Negligible
	R45	9.59	9.61	0.02	0	Negligible
	R46	8.91	8.92	0.01	0	Negligible
	R47	10.42	10.43	0.02	0	Negligible
	R48	9.18	9.19	0.01	0	Negligible
	R50	9.54	9.55	0.02	0	Negligible
Waveney	R30	9.66	9.69	0.03	0	Negligible
	R31	9.23	9.24	0.01	0	Negligible
	R32	10.05	10.08	0.03	0	Negligible

148. The results of the construction phase road traffic emissions assessment indicate that annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted to be below the respective Air Quality Objectives in the year of peak construction at all receptors, both 'without' and 'with' the project in place.

149. The change in NO_2 concentrations was no greater than 2% at all receptors; this corresponded to a 'negligible' impact due to low total NO_2 concentrations, in accordance with IAQM and EPUK guidance (IAQM and EPUK, 2017).

150. All predicted NO_2 concentrations were well below 60µg.m^{-3} and therefore, in accordance with Defra guidance in LAQM.TG (16) (Defra 2016), the 1-hour mean objective is unlikely to be exceeded (see Table 26.1). Based on the calculation provided by Defra, as detailed in section 26.4.1.2.10, the short-term PM_{10} objective was predicted to be met at all modelled locations (objective being less than 35 exceedances of the daily mean objective of 50µg.m^{-3}). Using the Defra calculation, there was no change in the number of days exceeding the daily mean objective between the 'without' and 'with' project scenarios.

151. This assessment concludes that project-generated construction traffic impacts upon local air quality are not significant based upon:

- A predicted negligible impact at all receptor locations;
- Predicted pollutant concentrations were below the relevant Air Quality Objectives at all considered receptor locations;
- Project-generated construction traffic was not predicted to cause a breach of any of the Air Quality Objectives at any identified sensitive receptor locations; and
- A conservative approach to the assessment was taken, with the use of 2017 emission factors for predicted 2027 levels, background concentrations and NO_x to NO_2 conversion rates in the future year assessment scenarios.

Ecological receptors

152. The results of the assessment of nutrient nitrogen deposition on designated ecological sites (as shown in Figure 26.5) are detailed in Table 26.42.

Table 26.42 Scenario 1 nutrient nitrogen deposition results

Designated ecological site	Transect ID	Nutrient nitrogen deposition (kgN.ha.y^{-1})		Change (kgN.ha.y^{-1})	Change as % of lowest CL
		Without Norfolk Boreas Scenario 1	With Norfolk Boreas Scenario 1		
Felbrigg Woods SSSI	T1-1	0.57	0.61	0.04	0
	T1-2	0.19	0.20	0.01	0
	T1-3	0.12	0.13	0.01	0
	T1-4	0.09	0.09	0.00	0
	T1-5	0.07	0.08	0.00	0
	T1-6	0.07	0.07	0.00	0
Breydon Water SSSI	T5-1	0.54	0.55	0.01	0
	T5-2	0.25	0.26	0.01	0
	T5-3	0.18	0.18	0.00	0
	T5-4	0.14	0.15	0.00	0
	T5-5	0.14	0.14	0.00	0
	T6-1	2.99	2.99	0.00	0
	T6-2	0.45	0.45	0.00	0
	T6-3	0.27	0.28	0.00	0

Designated ecological site	Transect ID	Nutrient nitrogen deposition (kgN.ha.y^{-1})		Change (kgN.ha.y^{-1})	Change as % of lowest CL
		Without Norfolk Boreas Scenario 1	With Norfolk Boreas Scenario 1		
	T6-4	0.21	0.21	0.00	0
	T6-5	0.18	0.18	0.00	0
Broadland SPA	T8-1	1.90	1.96	0.05	1
	T8-2	0.30	0.31	0.01	0
	T8-3	0.19	0.19	0.00	0
	T8-4	0.15	0.15	0.00	0
	T8-5	1.90	1.96	0.05	0
Holly Meadow Farm SSSI	T14-1	1.68	1.70	0.02	0
	T14-2	0.51	0.51	0.01	0
	T14-3	0.32	0.32	0.00	0
	T14-4	0.24	0.24	0.00	0
	T14-5	0.19	0.19	0.00	0
Potter and Scarning Fens SSSI	T15-1	2.38	2.41	0.03	0
	T15-2	0.33	0.33	0.00	0
	T15-3	0.17	0.17	0.00	0
	T15-4	0.12	0.12	0.00	0
	T15-5	0.09	0.09	0.00	0
River Wensum SSSI	T17-1	1.68	1.74	0.06	0
	T17-2	0.33	0.34	0.01	0
	T17-3	0.22	0.22	0.01	0
	T17-4	0.16	0.17	0.00	0
	T17-5	0.14	0.14	0.00	0
	T18-1	1.09	1.12	0.04	0
	T18-2	0.17	0.18	0.01	0
	T18-3	0.11	0.11	0.00	0
	T18-4	0.09	0.09	0.00	0
	T18-5	0.08	0.08	0.00	0

153. At all locations, increases in nutrient nitrogen deposition were 1% or below of the relevant CL, and are therefore considered to be **not significant**, in accordance with Environment Agency guidance (Environment Agency, 2017).

26.7.5 Potential Impacts during Operation

26.7.5.1.1 Scenario 1 and Scenario 2

154. Operational phase impacts were scoped out of the assessment, as agreed by the Planning Inspectorate (Planning Inspectorate, 2017, also see Table 26.4), and therefore they have not been considered within this assessment.

26.7.6 Potential Impacts during Decommissioning

26.7.6.1.1 Scenario 1 and Scenario 2

155. This section describes the potential impacts of the decommissioning of the project with regards to impacts on air quality. Further details are provided within Chapter 5 Project Description.

156. No decision has been made regarding the final decommissioning policy for the project, as it is recognised that industry best practice, rules and legislation change over time. It is likely the cables would be pulled through the ducts and removed, with the ducts themselves left *in situ*. As such, there would be **no significant impact** for any receptor upon decommissioning at the landfall or along the onshore cable route.

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

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

158. Whilst details regarding the decommissioning of the onshore project substation are currently unknown, considering the worst case assumptions for both scenarios which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be similar to those during construction and therefore **no significant impact**.

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

26.8 Cumulative Impacts

160. The CIA was undertaken in two stages. The first stage of the assessment was to consider the potential for the impacts assessed as part of the project to lead to cumulative impacts in conjunction with other projects. The first stage of the assessment is detailed in Table 26.43.

Table 26.43 Potential cumulative impacts

Impact		Potential for cumulative impact	Rationale
Construction			
1	Construction dust and fine particulate matter	Yes	There is potential for cumulative construction dust impacts where projects occur within 700m of each other.
2	Construction phase road traffic emissions	Yes	Where the construction phase of the project overlaps with other projects, there is the potential for cumulative impacts associated with project-generated traffic emissions on the local road network.
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.			

161. The second stage of the CIA is to evaluate the projects considered for the CIA to determine whether a cumulative impact is likely. The considered projects and their anticipated potential for cumulative impact are detailed in Table 26.44.

162. Table 26.44 summarises those projects which have been scoped in to the CIA due to their potential temporal overlap with the project. The remainder of the section details the nature of the cumulative impacts against all those receptors scoped in for cumulative assessment.

163. Projects identified for potential cumulative impacts that were agreed as part of the Norfolk Boreas PEIR (Norfolk Boreas Limited, 2018). These projects, as well as any relevant development applications submitted since this consultation have been considered and their anticipated potential for cumulative impact are detailed in Table 26.44.

Table 26.44 Summary of projects considered for the CIA in relation to air quality

Project	Status	Development period	[1]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
National Infrastructure Planning							
Norfolk Vanguard Offshore Wind Farm	Application submitted	Expected construction 2020 to 2025	0 – projects are co-located	Full ES available: https://infrastructure.planninginspectorate.gov.uk/proje	High	Yes (Scenario 1 only)	Under Scenario 1, the overlap between the proposed project boundaries for Norfolk Boreas and Norfolk Vanguard may result in direct and / or indirect impacts during construction and operation. Construction activities for Norfolk Vanguard along the cable route will be complete prior to commencement of cable-pulling activities for Norfolk Boreas. However, construction of the onshore project substation and National Grid extension sites will overlap. Scenario 2 assumes that the Norfolk Vanguard project would not be constructed. There is therefore no potential for cumulative impacts to occur under this scenario.
Hornsea Project Three Offshore Wind Farm	Application submitted	Expected construction start date 2021. Duration 6 to	0 – cable intersects project	Full ES available: https://infrastructure.planninginspectorate.gov.uk/projects/eastern/hor	High	Yes	There is potential for the construction phases of Norfolk Boreas and Hornsea Project Three to overlap. This project has therefore been considered in the air quality CIA for both scenarios.

[1] Shortest distance between the considered project and Norfolk Boreas – unless specified otherwise.

Project	Status	Development period	[1]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
		10 years dependent on phasing.	32km between substation locations	nsea-project-three-offshore-wind-farm/			
Dudgeon Offshore Wind Farm	Commissioned	Constructed	0	http://dudgeonoffshorewind.co.uk/	High	No	The Dudgeon Offshore Windfarm has been constructed. Operational phase traffic movements associated with the Dudgeon Offshore Windfarm are very minimal, and therefore it is not considered that there would be a significant cumulative impact associated with concurrent operational phase for Dudgeon OWF and construction phase traffic movements for Norfolk Boreas. Significant air quality impacts are therefore not anticipated, and this project has not been considered in the air quality CIA.
A47 corridor improvement programme – North Tuddenham to Easton	Pre-application (application due 2020)	Start works 2021 Open May 2023	26.7	https://highwaysengland.co.uk/projects/a47-north-tuddenham-to-easton-improvement-scheme/	Medium	No	It is anticipated that the construction works associated with the A47 improvements will be completed prior to commencement of the Norfolk Boreas construction phase. Cumulative impacts associated with traffic

Project	Status	Development period	[1]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
A47 corridor improvement programme – A47 Blofield to North Burlingham	Pre-application (application due 2019)	Start works 2021 Open 2022	23	https://highwaysengland.co.uk/projects/a47-blofield-to-north-burlingham/	Medium	No	emissions are therefore not anticipated and this project has not been included in the air quality CIA.
A47 corridor improvement programme – A47 / A11 Thickthorn Junction	Pre-application (application due 2019)	Start works 2021 Open 2023	18	https://highwaysengland.co.uk/projects/a47-thickthorn-junction/	Medium	No	
Norwich Western Link	Pre-application	Expected construction start late 2022	2.8	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/norwich/norwich-western-link	Medium	No	As the project is at the pre-application stage, there is insufficient information within the public domain to enable an air quality CIA for traffic emissions to be carried out. This project was therefore not taken forward into the air quality CIA.
Third River Crossing, Great Yarmouth	Pre-application (application due 2019)	Expected construction start late in 2020 Open early 2023	28	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-yarmouth/third-river-crossing	Medium	No	As the project is at the pre-application stage, there is insufficient information within the public domain to enable an air quality CIA for traffic emissions to be carried out. This project was therefore not taken forward into the air quality CIA.

Project	Status	Development period	[1]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
King's Lynn B Power Station amendments	Approved	Expected construction start 2019 to 2022	28	https://www.kingslynnbccgt.co.uk/	Medium	No	As the project is at the pre-application stage, there is insufficient information within the public domain to enable an air quality CIA for traffic emissions to be carried out. This project was therefore not taken forward into the air quality CIA.
North Norfolk District Council							
PF/17/1951 Erection of 43 dwellings and new access with associated landscaping, highways and external works	Approved	Anticipated Q2 2018	0.7	Application available: https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_92323	High	No	Traffic movements associated with future residential developments within the study area were included in the future baseline traffic growth predictions. The cumulative impact of this development with the Norfolk Boreas project has therefore been considered in the air quality assessment and not taken forward within the CIA for this chapter

Project	Status	Development period	[1]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
Bacton and Walcott Coastal Management Scheme	Approved	Construction start date Spring 2019	1.0	Public information leaflets available: https://www.north-norfolk.gov.uk/media/3371/bacton-to-walcott-public-information-booklet-july-2017.pdf	Medium	No	It is unlikely that the proposed project would lead to significant increases in traffic during the construction phase and therefore there would be no potential for cumulative impact. There would be no potential for cumulative impacts during the operational phase of the coastal protection scheme and is not taken forward within the CIA for this chapter
Coastal defence/protection works, Happisburgh PF/18/0751	Approved	Coastal protection over 10 years duration from August 2018.	0.12	https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_93543	Medium	No	It is unlikely that the proposed project would lead to significant increases in traffic during the construction phase and therefore there would be no potential for cumulative impact. There would be no potential for cumulative impacts during the operational phase of the coastal protection scheme and is not taken forward within the CIA for this chapter
Breckland Council							
Erection of 85 Dwellings with Associated Open Space 3PL/2018/1246/F	Awaiting Decision	Application received 04/10/18.	1.26	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2018/1246/F&from=planningSearch	Medium	No	Traffic movements associated with future residential developments within the study area were included in the future baseline traffic growth predictions. The cumulative impact of this development with the Norfolk

Project	Status	Development period	[1]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
							Boreas project has therefore been considered in the air quality assessment and not taken forward within the CIA for this chapter
Residential development of 40 No. units comprising a mix of housing types, accommodating open space and appropriate associated infrastructure with vehicle access via Hall Road 3PL/2018/0993/F	Approved	Application approved 11/02/19. Construction must begin within 2 years.	1.42	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2018/0993/F&from=planningSearch	Medium	No	Traffic movements associated with future residential developments within the study area were included in the future baseline traffic growth predictions. The cumulative impact of this development with the Norfolk Boreas project has therefore been considered in the air quality assessment and not taken forward within the CIA for this chapter

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

Scenario 1

- Norfolk Vanguard Offshore Wind Farm; and
- Hornsea Project Three Offshore Wind Farm.

Scenario 2

- Hornsea Project Three Offshore Wind Farm.

26.8.1 Cumulative Impacts during Construction

26.8.1.1 Norfolk Boreas and Norfolk Vanguard - Scenario 1

165. There is the potential for cumulative impacts associated with the Norfolk Vanguard project, as the construction of the onshore project substations and National Grid extension sites may overlap. Both Norfolk Vanguard and Norfolk Boreas have carried out construction dust assessments which include a suite of best practice mitigation methods to minimise emissions of dust and fine particulate matter during construction which will be implemented across the onshore project area. IAQM guidance (IAQM, 2014) states that, with the implementation of the recommended mitigation, impacts will be not significant. It is therefore not anticipated that there would be significant cumulative impacts associated with construction phase dust emissions.

166. A construction phase traffic emissions assessment has been undertaken for both Norfolk Vanguard and Norfolk Boreas, which is based on the peak construction intensity during the projects. The peak construction intensity is not anticipated to occur during the construction of the onshore project substations and National Grid extensions. The indicative programmes for both Norfolk Vanguard and Norfolk Boreas indicates that Norfolk Vanguard would be completing its cable pulling phase at the same time that Norfolk Boreas commences construction at the onshore project substation and landfall. It is anticipated that the cumulative traffic demand of these phases would not result in a greater impact than that of the assessed Norfolk Boreas worst case assumptions.

167. Peak construction traffic has been assessed and it is concluded that no significant impacts would be experienced for either project, at both human and ecological receptors, and therefore a significant cumulative impact is not anticipated to be experienced due to traffic associated with the onshore project substation construction.

168. Cumulative impacts during construction with Norfolk Vanguard are therefore considered to be **not significant**.

26.8.1.2 Norfolk Boreas and Hornsea Project Three - Scenario 1 and Scenario 2

169. It is not anticipated that any of the projects considered in the CIA would lead to a cumulative impact in conjunction with the project, with the exception of Hornsea Project Three Offshore Wind Farm. The construction phase could overlap with the project under both Scenario 1 and Scenario 2 of Norfolk Boreas. The Hornsea Project Three ES was submitted in May 2018, and traffic and HGV demand was presented on 38 road links across the study area. This is discussed in more detail in Chapter 24 Traffic and Transport.

26.8.1.2.1 Cumulative Impact 1: Construction dust and fine particulate matter

170. Hornsea Project Three carried out a construction dust impact assessment in accordance with IAQM guidance. In accordance with the guidance, the implementation of mitigation measures which are commensurate with the level of dust risk of the site would result in impacts that are not significant. Significant cumulative impacts are therefore highly unlikely.

26.8.1.2.2 Cumulative Impact 2: Construction vehicle exhaust emissions

171. Cumulative traffic flows from Hornsea Project Three were added to the road links considered for both Scenario 1 and Scenario 2. The 24-hour AADT flows and HGV percentages used in the cumulative air quality assessment are detailed in Appendix 26.2.

172. Results of the CIA at each receptor are provided in Appendix 26.4 and are summarised below for Scenario 2 and Scenario 1 separately.

Scenario 2

173. The results of the cumulative construction phase road traffic emissions assessment indicate that annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted to be below the respective Air Quality Objectives in the year of peak construction (2024) under Scenario 2 at all receptors, both 'without' and 'with' the project in place.

174. The change in NO_2 concentrations was 5% or less at all receptors; this corresponded to a 'negligible' impact due to low total NO_2 concentrations, in accordance with IAQM and EPUK guidance (IAQM and EPUK, 2017). Receptor R71 was predicted to experience a 3% change in concentrations, which corresponded to a 'slight adverse' impact as the total concentration is above 30µg.m^{-3}. This is because this receptor is located close to the Broadland Northway, which has relatively high traffic flows.

175. All predicted NO_2 concentrations were well below 60µg.m^{-3} and therefore, in accordance with Defra guidance in LAQM.TG (16) (Defra, 2016), the 1-hour mean objective is unlikely to be exceeded (see Table 26.1). Based on the calculation provided by Defra, as detailed in section 26.4.1.2.10, the short-term PM_{10} objective

was predicted to be met at all modelled locations (objective being less than 35 exceedances of the daily mean objective of 50µg.m^{-3}). Using the Defra calculation, there was no change in the number of days exceeding the daily mean objective between the 'without' and 'with' project assessments.

176. As detailed in Appendix 26.4, increases in nutrient nitrogen deposition under Scenario 2 were above 1% of the relevant CL at the transect locations closest to the road network within Felbrigg Woods SSSI (2%) and River Wensum SSSI (2%). Impacts can therefore not be screened out at these locations.

177. The assessment was based on the CL of the most sensitive habitats present within the designated sites, which is considered a conservative approach. The next stage of the assessment is therefore to examine whether the most sensitive habitats are present at the locations closest to the road network at which higher deposition was predicted. This is discussed further in Chapter 22 Onshore Ecology.

178. In summary, the ecological assessment concluded that, at Felbrigg Woods SSSI, the localised, temporary nature of the impact would result in a **negligible** impact at this location. At River Wensum SSSI, the habitats considered relevant to the assessment were not anticipated to be present within 200m of the road network, and therefore impacts were unlikely. In addition, the modelling approach is conservative due to the use of base year emission factors for the 2024 and 2027 assessment years.

179. At all other locations considered in the assessment, increases in nutrient nitrogen deposition were no greater than 1% of the relevant CL, and are therefore considered to be **not significant**, in accordance with Environment Agency guidance (Environment Agency, 2017).

180. This assessment concludes that cumulative construction traffic impacts under Scenario 2 upon local air quality are not significant based upon:

- A predicted negligible impact at all receptor locations except one, which was predicted to experience a 'slight adverse' impact;
- Predicted pollutant concentrations were below the relevant Air Quality Objectives at all considered receptor locations;
- Project-generated construction traffic was not predicted to cause a breach of any of the Air Quality Objectives at any identified sensitive receptor location; and
- A conservative approach to the assessment was taken, with the use of 2017 emission factors for predicted 2024 levels, background concentrations and NO_x to NO_2 conversion rates in the future year assessment scenarios.

Scenario 1

181. The results of the construction phase road traffic emissions assessment indicate that annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted to be below the respective Air Quality Objectives in the year of peak construction at all receptors, both 'without' and 'with' the project in place.

182. The change in NO_2 concentrations was no greater than 2% at all receptors; this corresponded to a 'negligible' impact due to low total NO_2 concentrations, in accordance with IAQM and EPUK guidance (IAQM and EPUK, 2017).

183. All predicted NO_2 concentrations were well below 60µg.m^{-3} and therefore, in accordance with Defra guidance in LAQM.TG (16) (Defra 2016), the 1-hour mean objective is unlikely to be exceeded (see Table 26.1). Based on the calculation provided by Defra, as detailed in section 26.4.1.2.10, the short-term PM_{10} objective was predicted to be met at all modelled locations (objective being less than 35 exceedances of the daily mean objective of 50µg.m^{-3}). Using the Defra calculation, there was no change in the number of days exceeding the daily mean objective between the 'without' and 'with' project scenarios.

184. At all locations, increases in nutrient nitrogen deposition were 1% or below the relevant CL, and are therefore considered to be **not significant**, in accordance with Environment Agency guidance (Environment Agency, 2017).

185. This assessment concludes that project-generated construction traffic impacts upon local air quality are not significant based upon:

- A predicted negligible impact at all receptor locations;
- Predicted pollutant concentrations were below the relevant Air Quality Objectives at all considered receptor locations;
- Project-generated construction traffic was not predicted to cause a breach of any of the Air Quality Objectives at any identified sensitive receptor location; and
- A conservative approach to the assessment was taken, with the use of 2017 emission factors for predicted 2027 levels, background concentrations and NO_x to NO_2 conversion rates in the future year assessment scenarios.

26.8.2 Cumulative Impacts during Operation

186. There are not anticipated to be any significant cumulative impacts associated with Hornsea Project Three, Norfolk Vanguard and Norfolk Boreas as operational phase impacts were scoped out of both assessments, as agreed with the SoS in the Scoping Opinion (Planning Inspectorate, June 2017).

26.8.3 Cumulative Impacts during Decommissioning

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

26.9 Transboundary Impacts

188. There is no pathway for transboundary impacts; therefore, no transboundary impacts are anticipated.

26.10 Inter-relationships

189. The chapters detailed in Table 26.45 have been identified as having inter-relationships with air quality.

Table 26.45 Air quality inter-relationships

Topic and description	Where addressed in this chapter	Rationale
Chapter 24 Traffic and Transport	Section 26.6.4.2	Pollutant emissions from traffic movements associated with the project have the potential to impact on air quality.
Chapter 22 Onshore Ecology	Section 26.6.4.2	Potential ecological receptors may be impacted by changes to air quality.
Chapter 23 Onshore Ornithology	Section 26.6.4.2	Potential ecological receptors may be impacted by changes to air quality.
Chapter 27 Human Health	Section 26.7	There may be human health impacts associated with increases in pollutant concentrations at sensitive receptors

26.11 Interactions

The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. The worst case impacts assessed within the chapter take these interactions into account and for the impact assessments are considered conservative and robust. For clarity the areas of interaction between impacts are presented in Table 26.46, along with an indication as to whether the interaction may give rise to synergistic impacts.

Table 26.46 Interaction between impacts

Potential interaction between impacts		
Construction		
	1 Construction dust and fine particulate matter	**2 Construction vehicle exhaust emissions**
1 Construction dust and fine particulate matter	-	Yes
2 Construction vehicle exhaust emissions	Yes	-
Operation		
Operational impacts on air quality have been scoped out.		
Decommissioning		
It is anticipated that the decommissioning impacts would be similar in nature to those of construction.		

26.12 Summary

190. A summary of the potential impacts identified with relation to air quality is provided in Table 26.47 and Table 26.48 for Scenario 1 and Scenario 2 respectively. It has been concluded that impacts on air quality associated with construction phase dust and road traffic emissions would not be significant at both human and ecological receptors.

Table 26.47 Potential impacts identified for air quality under Scenario 1

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Construction						
1. Construction dust and fine particulate matter	Human receptors within 350m of onshore project area.	Dust Soiling: Medium sensitivity Human Health: Low sensitivity	Medium	Assessment methodology does not assign significance before mitigation.	Measures as recommended by the IAQM.	**Not significant**
2. Construction vehicle 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 0.72µg.m^{-3} at receptor R30	Overall **not significant**, negligible impacts at all receptors.	No additional mitigation measures required.	**Not significant**
	Designated ecological sites.	High	Pollutant concentrations at or below 1% of CL.	**Not Significant**	No additional mitigation measures required.	**Not Significant**
Operation						
Operational impacts on air quality have been scoped out.						
Decommissioning						
As per construction.						

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Cumulative - Construction						
1. Construction dust and fine particulate matter	As per construction					**Not significant**
2. Construction vehicle 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 0.99µg.m^{-3} at receptor R49.	Overall **not significant**, negligible impacts at all receptors.	No additional mitigation measures required.	**Not significant**
	Designated ecological sites.	High	Pollutant concentrations below at or below 1% of CL.	**Not Significant**	No additional mitigation measures required.	**Not Significant**
Cumulative – Operation and Decommissioning						
Cumulative air quality impacts are not anticipated to be experienced during operation or decommissioning.						

Table 26.48 Potential impacts identified for air quality under Scenario 2

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Construction						
1. Construction dust and fine particulate matter	Human receptors within 350m of onshore project area.	Dust Soiling: Medium sensitivity Human Health: Low sensitivity	Large	Assessment methodology does not assign significance before mitigation.	Measures as recommended by the IAQM.	**Not significant**
2. Construction vehicle 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**, negligible impacts at all receptors except slight adverse impact at one receptor (R71).	No additional mitigation measures required.	**Not significant**
	Designated ecological sites.	High	Pollutant concentrations at or below 1% of CL.	**Not significant**	No additional mitigation measures required.	**Not significant**
Operation						
Operational impacts on air quality have been scoped out.						
Decommissioning						
As per construction.						

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Cumulative - Construction						
1. Construction dust and fine particulate matter	As per construction					**Not significant**
2. Construction vehicle 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 1.89µg.m^{-3} at receptor R86	Overall **not significant**, negligible impacts at all receptors except slight adverse impact at one receptor (R71).	No additional mitigation measures required.	**Not significant**
	Designated ecological sites.	High	Pollutant concentrations above 1% of CL at Felbrigg Woods SSSI and River Wensum SSSI. Pollutant concentrations at or below 1% of CL at all other locations.	**Not significant** at all locations except Felbrigg Woods SSSI and River Wensum SSSI, where **negligible**.	No additional mitigation measures required.	**Not significant**
Cumulative – Operation and Decommissioning						
Cumulative air quality impacts are not anticipated to be experienced during operation or decommissioning.						

26.13 References

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