Hornsea Project Four: Environmental Statement (ES)

PINS Document Reference: A3.9
APFP Regulation 5(2)(a)

Volume A3, Chapter 9: Air Quality

Prepared Royal HaskoningDHV, July 2021
Checked Royal HaskoningDHV, July 2021
Accepted Thomas Watts, Orsted, August 2021
Approved Julian Carolan, Orsted, September 2021

A3.9
Version: B

Table of Contents

List of Tables

List of Figures

Glossary

Term	Definition
Code of Construction Practice (CoCP)	A document detailing the overarching principles of construction, contractor protocols, construction-related environmental management measures, pollution prevention measures, the selection of appropriate construction techniques and monitoring processes.
Commitment	A term used interchangeably with mitigation and enhancement measures. The purpose of Commitments is to reduce and/or eliminate Likely Significant Effects (LSEs), in EIA terms. Primary (Design) or Tertiary (Inherent) are both embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, Preliminary Environmental Information Report (PEIR) or Environmental Statement (ES)). Secondary commitments are incorporated to reduce LSE to environmentally acceptable levels following initial assessment i.e. so that residual effects are acceptable.
Cumulative effects	The combined effect of Hornsea Four in combination with the effects from a number of different projects, on the same single receptor/resource. Cumulative impacts are those that result from changes caused by other past, present or reasonably foreseeable actions together with Hornsea Project Four.
Design Envelope	A description of the range of possible elements that make up the Hornsea Project Four design options under consideration, as set out in detail in the Project Description. This envelope is used to define Hornsea Project Four for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
EIA Directive	European Union Directive 85/337/EEC, as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC and then codified by Directive 2011/92/EU of 13 December 2011 (as amended in 2014 by Directive 2014/52/EU).
EIA Regulations	Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
Energy balancing infrastructure (EBI)	The onshore substation includes energy balancing Infrastructure. These provide valuable services to the electrical grid, such as storing energy to meet periods of peak demand and improving overall reliability.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement (ES).
Environmental Statement (ES)	A document reporting the findings of the EIA and produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.

Term	Definition
Export cable corridor (ECC)	The specific corridor of seabed (seaward of Mean High Water Springs (MHWS)) and land (landward of MHWS) from the Hornsea Project Four array area to the Creyke Beck National Grid substation, within which the export cables will be located.
Habitats Regulations Assessment (HRA)	A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI) and compensatory measures.
Haul Road	The track along the onshore ECC which the construction traffic would use to access work fronts.
High Voltage Alternating Current (HVAC)	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
High Voltage Direct Current (HVDC)	High voltage direct current is the bulk transmission of electricity by direct current (DC), whereby the flow of electric charge is in one direction.
Hornsea Project Four Offshore Wind Farm	The term covers all elements of the project (i.e. both the offshore and onshore). Hornsea Four infrastructure will include offshore generating stations (wind turbines), electrical export cables to landfall, and connection to the electricity transmission network. Hereafter referred to as Hornsea Four.
Landfall	The generic term applied to the entire landfall area between Mean Low Water Spring (MLWS) tide and the Transition Joint Bay (TJB) inclusive of all construction works, including the offshore and onshore ECC, intertidal working area and landfall compound. Where the offshore cables come ashore east of Fraisthorpe.
Maximum Design Scenario (MDS)	The maximum design parameters of each Hornsea Four asset (both on and offshore) considered to be a worst case for any given assessment.
Mitigation	A term used interchangeably with Commitment(s) by the Applicant. Mitigation measures (Commitments) are embedded within the assessment at the relevant point in the EIA (e.g. at Scoping, PEIR or ES).
National Grid Electricity Transmission (NGET) substation	The grid connection location for Hornsea Four at Creyke Beck.
Onshore substation (OnSS)	Comprises a compound containing the electrical components for transforming the power supplied from Hornsea Project Four to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid. If a HVDC system is used the OnSS will also house equipment to convert the power from HVDC to HVAC
Order Limits	The limits within which Hornsea Project Four (the 'authorised project') may be carried out.
Orsted Hornsea Project Four Ltd.	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm Development Consent Order (DCO).
Planning Inspectorate (PINS)	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
Pollutant Standards	Concentrations of pollutants recorded over given time periods which are considered to be acceptable in relation to the effects of that pollutant on human health and the environment.

Term	Definition
Pollutant Objectives	The target date on which the pollutant Standards must be achieved.
Trenchless Techniques	Also referred to as trenchless crossing techniques or trenchless methods. These techniques include Horizontal Directional Drilling (HDD), thrust boring, auger boring, and pipe ramming, which allow ducts to be installed under an obstruction without breaking open the ground and digging a trench.

Acronyms

Acronym	Definition
AADT	Annual Average Daily Traffic
ADMS	Atmospheric Dispersion Modelling System
APIS	Air Pollution Information System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
CEH	Centre for Ecology and Hydrology
CL	Critical Load
CoCP	Code of Construction Practice
DCO	Development Consent Order
DECC	Department of Energy and Climate Change (now the Department for Business, Energy and Industrial Strategy)
Defra	Department for Environment Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DMRB	Design Manual for Roads and Bridges
EBI	Energy Balancing Infrastructure
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EPUK	Environmental Protection United Kingdom
ERYC	East Riding Yorkshire Council
ES	Environmental Statement
EU	European Union
HCC	Hull City Council
HGV	Heavy Goods Vehicle
HMSO	Her Majesty's Stationary Office
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAQM	Institute of Air Quality Management
IEMA	Institute of Environmental Management and Assessment
LAQM	Local Air Quality Management
LDV	Light Duty Vehicle
LSE	Likely Significant Effect

Acronym	Definition
MDS	Maximum Design Scenarios
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
NGET	National Grid Electricity Transmission
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OnSS	Onshore Substation
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PM_{10}	Particulate Matter with a mean aerodynamic diameter of less than 10 µm
$PM_{2.5}$	Particulate Matter with a mean aerodynamic diameter of less than 2.5 µm
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
UK	United Kingdom

Units

Unit	Definition
GW	gigawatt
kV	kilovolt
kW	kilowatt
km	kilometres
km/h	kilometres per hour
$mg.m^{-3}$	milligrams per cubic metre
$µg.m^{-3}$	micrograms per cubic metre

9.1 Introduction

9.1.1.1 Orsted Hornsea Project Four Limited (the 'Applicant') is proposing to develop the Hornsea Four Offshore Wind Farm (hereafter 'Hornsea Four'). Hornsea Four will be located approximately 69 km offshore the East Riding of Yorkshire in the Southern North Sea and will be the fourth project to be developed in the former Hornsea Zone. Hornsea Four will include both offshore and onshore infrastructure including an offshore generating station (wind farm), export cables to landfall, and on to an onshore substation (OnSS) with energy balancing infrastructure (EBI), and connection to the electricity transmission network.

9.1.1.2 This chapter of the Environmental Statement (ES) presents the results of the Environmental Impact Assessment (EIA) for the potential impacts of Hornsea Four on air quality receptors. Specifically, this chapter considers the potential impact of Hornsea Four landward of Mean High Water Springs (MHWS) during its construction, operation and maintenance, and decommissioning phases.

9.1.1.3 This chapter considers air quality only. Impacts on human health are presented in **Volume A4, Annex 5.8: Health Impact Assessment**.

9.2 Purpose

9.2.1.1 The primary purpose of the ES is to support the Development Consent Order (DCO) application for Hornsea Four under the Planning Act 2008 (the 2008 Act). This ES constitutes the environmental information for Hornsea Four and sets out the findings of the EIA.

9.2.1.2 The ES has been finalised with due consideration of pre-application consultation to date (see **Volume B1, Chapter 1: Consultation Report** and **Table 9.6: Consultation Responses.**) and the ES will accompany the application to the Planning Inspectorate (PINS) for Development Consent.

9.2.1.3 This ES chapter:

- Presents the existing environmental baseline established from desk studies, and consultation. Additional baseline monitoring was not considered to be required by East Riding Yorkshire Council (ERYC) or Hull City Council (HCC), as discussed in **Paragraph 9.6.2.1**;
- Presents the modelled future baseline air quality conditions;
- Presents the potential onshore environmental effects on air quality arising from Hornsea Four, based on the information gathered and the analysis and assessments undertaken to date;
- Identifies any assumptions and limitations encountered in compiling the environmental information; and
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

9.3 Planning and policy context and legislation

9.3.1 National Policy

9.3.1.1 Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to air quality, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, DECC 2011b).

9.3.1.2 NPS EN-1 includes guidance on what matters are to be considered in the assessment. These are summarised in **Table 9.1**.

9.3.1.3 The UK planning and policy context for Hornsea Four is set out in **Volume A1, Chapter 2: Planning and Policy Context**.

Table 9.1: Summary of NPD EN-1 provisions relevant to air quality.

Summary of NPS EN-1	How and where considered in the ES
Air Quality	
"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)	The impact of air emissions associated with construction-generated traffic at human and ecological receptors has been quantified and is presented in **Section 9.11**.

9.3.1.4 NPS EN-1 also highlights several factors relating to the determination of an application and in relation to mitigation. These are summarised in **Table 9.2**.

Table 9.2: Summary of NPS EN-1 policy on decision making relevant to air quality.

Summary of NPS EN-1 provisions	How and where considered in the ES
Air Quality	
"*The IPC* [hereafter the Secretary of State (SoS)] *should generally give air quality considerations substantial weight where a project would lead to a deterioration in air quality in an area or leads to a new area where air quality breaches any national air quality limits. However, air quality considerations will also be important where substantial changes in air quality levels are expected, even if this does not lead to any breaches of national air quality limits*" (EN-1 paragraph 5.2.9)	The impacts of air emissions associated with Hornsea Four is presented in **Section 9.11** and **Volume A4, Annex 5.1: Impacts Register**.
"*In all cases the SoS must take account of any relevant statutory air quality limits. Where a project is likely to lead to a breach of such limits the developers should work with the relevant authorities to secure appropriate mitigation measures to allow the proposal to proceed. In the event that a project will lead to non-compliance with a statutory limit the SoS should refuse consent*" (EN-1 paragraph 5.2.10)	The impacts of air emissions associated with Hornsea Four is presented in **Section 9.11** and **Volume A4, Annex 5.1: Impacts Register**. Any potential for breaches of air quality limits is set out, along with proposed mitigation, where necessary.
"*The SoS should consider whether mitigation measures are needed both for operational and construction emissions over and above any which may form part of the project application. A construction management plan may help codify mitigation at this stage. In doing so the Planning Inspectorate may refer to the conditions and advice in the Air Quality Strategy or any successor to it. The mitigation identified in Section 5.13 on traffic and transport impacts will help mitigate the effects of air emissions from transport.*" (EN-1 paragraph 5.2.11, 5.2.12 and 5.2.13)	The draft DCO includes provision for a Code of Construction Practice (CoCP) under DCO Requirement 17. In addition, an outline CoCP has been prepared and submitted to support this ES (**Volume F2, Chapter 2: Outline Code of Construction Practice**).

9.3.2 Local Policy

9.3.2.1 The ERYC East Riding Local Plan Strategy Document (ERYC 2016) was adopted in April 2016 and sets out the management of growth and development in the region until 2029. ERYC is undertaking consultation on an update to the Local Plan, however no changes have yet been formally adopted and therefore any changes to the relevant policies have not been reported. HCC adopted its Local Plan (HCC 2017) in November 2017 which guides development in the city until 2032. The Local Plan Strategy Document was reviewed, and the policy summarised in **Table 9.3** was identified with regard to air quality and Hornsea Four.

Table 9.3: Summary of local planning policy on decision making relevant to air quality.

Summary of Local Planning Policy	How and where considered in the ES
ERYC	
"Policy EC5: Supporting the energy sector *A. Proposals for the development of the energy sector, excluding wind energy but including the other types of development listed in Table 7, will be supported where any significant adverse impacts are addressed satisfactorily, and the residual harm is outweighed by the wider benefits of the proposal. Developments and their associated infrastructure should be acceptable in terms of:* *1. The cumulative impact of the proposal with other existing and proposed energy sector developments;* *[...]* *3. The effects of development on:* *i. local amenity, including noise, air and water quality, traffic, vibration, dust and visual impact;* *ii. biodiversity, geodiversity and nature, particularly in relation to designations, displacement, disturbance and collision and the impact of emissions/contamination;* *[...]* *B. Where appropriate, proposals should include provision for decommissioning at the end of their operational life. Where decommissioning is necessary, the site should be restored, with minimal adverse impact on amenity, landscape and biodiversity, and opportunities taken for enhancement of these features. [...]"*	Though this policy specifically excludes wind energy, the impact of construction-generated traffic from Hornsea Four has been assessed at both human and ecological receptors as presented in **Section 9.11.1** and **Volume A4, Annex 5.1: Impacts Register**. The significance of impacts on ecological receptors is presented in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** (with the assessment on the site itself contained within **Volume B2, Chapter 2: Report to Inform Appropriate Assessment** and **Chapter 3 Ecology and Nature Conservation**. Cumulative effects have been considered as described in **Section 9.12**. Decommissioning effects were considered as detailed in **Volume A4, Annex 5.1: Impacts Register**.
HCC	
"Policy 18 Renewable and low carbon energy *[...]* *2. Development that generates, transmits and/or stores renewable and/or low carbon energy will be supported where the impact is or can be made acceptable. Potential impacts that are particularly relevant to this type of development are:* *a. local amenity, including noise, air quality, water quality, traffic, vibration, dust, visual impact, shadow flicker and odour;* *b. biodiversity, particularly in relation to national and international designations, and priority species and habitats and geodiversity; [...]"*	Air quality impacts resulting from Hornsea Four have been considered in **Section 9.11** and **Volume A4, Annex 5.1: Impacts Register**.
"Policy 47 Atmospheric Pollution *[...]* *2. An assessment of air quality must accompany applications for major development which could individually, or cumulatively with planning permissions and/or developments under construction:* *a. worsen air quality within an Air Quality Management Area;* *[...]*	Air quality impacts resulting from Hornsea Four have been considered in **Section 9.11** and **Volume A4, Annex 5.1: Impacts Register**. The scope and methodology were agreed with ERYC as part of the Evidence Plan Process as detailed in **Table 9.6**.

Summary of Local Planning Policy	How and where considered in the ES
3. The scope of any assessment of air quality should be agreed prior to the submission of a planning application and will be required to: *a. identify the site, development proposal and area in which the impacts will be assessed;* *b. assess the existing air quality;* *c. assess the impact of the proposal on air quality individually and in conjunction with any outstanding planning permission or development under construction; and* *d. identify mitigation measures and quantify the impact of those measures.* *4. In additional to criteria 2 and 3 above, if the development is located within 200m of the Humber Estuary Special Area of Conservation (SAC), the application should specifically address the impact of the proposal on the SAC designated saltmarsh. Where effects cannot be avoided, appropriate mitigation measures should be provided to ensure that there is no adverse effect on the integrity of the Humber Estuary SAC.* *5. Development which cannot appropriately mitigate air quality concerns, including dust and odour, will only be supported where the social and economic benefits significantly outweigh the negative impact on air quality."*	A cumulative assessment is presented in **Section 9.12**. Impacts on receptors within the Air Quality Management Area (AQMA) and the saltmarsh feature of the Humber Estuary SAC, which is adjacent to a potential construction traffic link, have been considered and are presented in **Section 9.11.1**.

9.3.2.2 HCC has produced a Supplementary Planning Document (SPD) on Environmental Quality (HCC 2019b). This document and its appendices detail HCC's requirements with regard to environmental assessment of a project, including air quality. The requirements of the SPD were considered within this assessment.

9.3.3 Legislation

United Kingdom legislation

9.3.3.1 Relevant European Union (EU) Air Quality Directives were adopted into law in England through the Air Quality Standards Regulations 2010. These 2010 regulations were subsequently amended post-Brexit by The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (Her Majesty's Stationary Office (HMSO) 2019); however, no changes have been made to the air quality standards or Objectives as set out in the following sections.

9.3.3.2 The Environment Act 1995 (part IV) enables and required local authorities in the UK to monitor and review air quality in their area. It enables the establishment of designated 'air quality management areas' in areas where improvements are considered necessary. The act was amended post Brexit by The Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019

United Kingdom Air Quality Strategy

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

9.3.3.4 The UK Air Quality Strategy was originally adopted in 1997 (Department of Environment 1997) and has been reviewed and updated to take account of the evolving European 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 Air Quality Strategy 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 July 2007 (Department for Environment, Food and Rural Affairs (Defra)). In 2019 the Government published its Clean Air Strategy (Defra 2019).

Local Air Quality Management

9.3.3.5 The Standards and Objectives relevant to the LAQM framework have been prescribed through The Air Quality (England) Regulations (2000) (HMSO) 2000), The Air Quality (England) (Amendment) Regulations (2002) (HMSO 2002) and The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (HMSO 2019). The EU Limit Values have been implemented via the Air Quality Standards Regulations (2019).

9.3.3.6 The current air quality standards and Objectives of relevance to this assessment are presented in **Table 9.4**. Pollutant standards relate to ambient pollutant concentrations in air, based on medical and scientific evidence of how each pollutant affects human health. Pollutant Objectives, however, incorporate target dates and averaging periods which consider economic considerations, practicability and technical feasibility.

9.3.3.7 Where an air quality Objective is not being met, local planning authorities must designate those areas as AQMAs and take action to work towards meeting the Objectives. Following the designation of an AQMA, local planning authorities are required to develop an Air Quality Action Plan (AQAP) to work towards meeting the Objectives and to improve air quality locally.

9.3.3.8 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 9.4: Air Quality Strategy Objectives (England) for the Purposes of LAQM.

Pollutant	Air Quality Objective		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 (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 ($PM_{2.5}$)	25 µg.m^{-3}	Annual mean	2020
	15% cut in annual mean (urban background exposure)	2010 - 2020	Between 2010 and 2020

*The way the Objectives are to be measured is set out in the UK Air Quality (England) Regulations (HMSO, 2000)

Critical Levels for the Protection of Vegetation and Ecosystems

9.3.3.9 National air quality Objectives also apply for the protection of vegetation and ecosystems, which are termed Critical Levels. Critical Levels apply irrespective of habitat type and are based on the concentration of the relevant pollutants in air. The Critical Levels of relevance to this assessment relate to concentrations of NOx and ammonia (NH_3) and are detailed in **Table 9.5**. The Critical Level for ammonia is not included within the Air Quality Standards Regulations; however, a Critical Level for this pollutant is set out within the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (CLRTAP) and is adopted within air quality assessments.

9.3.3.10 NO_x Critical Levels are provided as both long and short-term averaging periods. IAQM guidance (IAQM, 2020) recommends that only the annual mean NO_x Critical Level is used in assessments due to the comparative importance of annual effects to impacts upon vegetation, except where specifically required by the regulator where high short-term emissions may occur, such as from an industrial stack emission source. As such, given the consistent traffic exhaust emission source along road links, only the annual mean Critical Level was considered.

Table 9.5: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration (µg.m^{-3})	Measured as	To Be Achieved By
Oxides of Nitrogen (NO_X)	30	Annual mean	31/12/2000
Ammonia (NH_3)	3	Annual mean	-
	1 (for lichens and bryophytes)	Annual mean	-

9.4 Consultation

9.4.1.1 Consultation is a key part of the DCO application process. Consultation regarding air quality has been conducted through the EIA Scoping process (Orsted 2018) and formal consultation on the Preliminary Environmental Information Report (PEIR) under section 42 of the 2008 Act. An overview of the project consultation process is presented within **Volume A1, Chapter 6: Consultation**. Agreements made with consultees within the Evidence Plan process are set out in the topic specific Evidence Plan Logs which are appendices to the Hornsea Four Evidence Plan (**Volume B1, Annex 1.1: Evidence Plan**), an annex of the Hornsea Four Consultation Report (**Volume B1, Chapter 1: Consultation Report**). All agreements within the Evidence Plan Logs have unique identifier codes which have been used throughout this document to signpost to the specific agreements made (e.g. ON-HUM-1.1).

9.4.1.2 A summary of the key issues raised during consultation specific to air quality is outlined in **Table 9.6**, together with how these issues have been considered in the production of this ES. In light of comments from the Planning Inspectorate in the Scoping Opinion (Planning Inspectorate 2018), a full air quality assessment chapter has been included within this ES.

Table 9.6: Consultation Responses.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
Public Health England	14 November 2018 Scoping Consultation Response	*"When considering a baseline (of existing air quality) and in the assessment and future monitoring of impacts these:* • *should include consideration of impacts on existing areas of poor air quality e.g.* • *existing or proposed local authority Air Quality Management Areas (AQMAs)* • *should include modelling using appropriate meteorological data (i.e. come from the nearest suitable meteorological station and include a range of years and worst-case conditions)* *should include modelling taking into account local topography"*	The baseline section is provided in **Section 9.7**. The methodology and impact assessment in relation to construction phase road traffic exhaust emissions is presented in **Sections 9.10** and **9.11.1**. . Monitoring was not requested by ERYC, and the use of existing publicly available monitoring data was agreed during consultation via email on 29 May 2019.
Planning Inspectorate (PINS)	26 November 2018 Scoping Opinion.	*"The Inspectorate notes that no information about the likely dust generation during the construction phase is provided. The likely receptors affected the scoping report concludes a negligible magnitude of effect but does not provide any basis for this conclusion. It is not clear from the Scoping*	Good practice air quality management measures will be applied during construction, as described in Institute of Air Quality Management (IAQM) guidance, as detailed in Commitment Co114 in **Table**

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		Report how receptors have been identified. Furthermore, there is no calculation of how study areas were defined, and no sources are determined to support the definition of 500 m and 200 m boundaries. These are also not determined in Figure 7.15 (of the Scoping Opinion) and therefore sensitive receptors within these boundaries cannot be clearly identified. Therefore, the Inspectorate does not agree to scope this issue out of the ES. The ES should assess impacts from dust generation during construction where significant effects are likely."	9.10. These measures are detailed in the outline CoCP (**Volume F2, Chapter 2: Outline Code of Construction Practice**) (Co124). The distance boundaries from pollution sources within which receptors were considered are shown in **Figure 9.1** to **Figure 9.6.** The assessment of construction phase dust emissions was not carried forward to the ES stage, as no LSE were identified at the PEIR stage, as detailed in **Table 9.9**.
PINS	26 November 2018 Scoping Opinion.	*"The Scoping Report does not provide evidence to demonstrate an absence of sensitive receptors within the 200m buffer of access roads. The Scoping Report does state (paragraph 7.9.4.4) that there will be low traffic movements such that do not meet the thresholds defined by IAQM. However, there is no evidence provided to support this statement and there are no current definitive estimates of vehicle movements during construction, operation and decommissioning.* *Whilst the Inspectorate notes the reliance on embedded mitigation measures and the corresponding commitments in Annex B, it cannot agree to scope this issue out at this stage in the absence of justification for determining sensitive receptor locations and the lack of data or justified estimations on vehicular movement through all phases of development."*	The identification of receptors within 200 m of access roads is detailed in **Section 9.10.12**. The number of project-generated vehicle movements on the assessed road links is detailed in **Table 9.13**. The assessment of construction phase road traffic exhaust emissions is provided in **Section 9.11.1**.
PINS	26 November 2018 Scoping Opinion.	*"The Inspectorate notes that the Scoping Report states in paragraph 3.6.1.3 that the decommissioning phase will be the reverse of the construction phase with similar numbers of vehicles. Since the Inspectorate has not agreed to scope out dust generation during the construction phase as specified in*	Good practice air quality management measures will be applied during decommissioning, as described in IAQM guidance or equivalent (Co114), as described in **Table 9.10**.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		4.21.1 above, the Inspectorate cannot agree to scope this matter. The ES should assess impacts from dust generation during decommissioning where significant effects are likely."	The assessment of decommissioning impacts and effects has not been considered in detail in the ES, with justification provided in **Volume A4, Annex 5.1: Impacts Register**.
PINS	26 November 2018 Scoping Opinion.	*"The Inspectorate notes that a 500 m study area has been determined to assess potential significant effects with regard to dust as derived from the IAQM guidance and Design Manual for Roads and Bridges (DMRB). Sensitive receptors are only considered within 350 m as specified in 7.9.4.3 which is not consistent with the previously determined study area. The ES must be consistent and clearly state and justify the study area applied based on the anticipated extent of impacts."*	The air quality study area is defined in **Section 9.5** and shown in **Figure 9.1**.
Natural England	26 November 2018 Scoping Opinion.	Welcome that Sites of Special Scientific Interest (SSSIs) have been mapped as Sensitive Receptors and would wish to see this reflected in PEIR.	The designated ecological sites considered in the assessment are detailed in **Section 9.10.12** and shown on **Figure 9.9**. Reference should be made to **Volume A2, Chapter 2: Benthic and Intertidal Ecology** and **Chapter 3 Ecology and Nature Conservation** for further information relating to designated ecological sites.
East Riding of York Council (ERYC)	22 January 2019 Late Scoping Consultation Response	*"The nature of the operational phase is such that it is unlikely to result in significant impacts on air quality and I agree it will be appropriate for this element to be scoped out of the ES. For the construction and decommissioning phases of development, the nature of activities and types of machinery / plant involved represent a risk of potentially significant, negative impacts at sensitive receptor locations from dust and/or vehicle emissions. It will be inappropriate, therefore, to scope these elements out of the ES and an assessment of impacts from emissions to air during*	We acknowledge the agreement from ERYC to scope out operational phase air quality impacts from the PEIR, therefore no further consideration is required in the ES. The effects of construction on emissions to air within ERYC's area of jurisdiction were assessed at the PEIR stage and no significant effects were identified. As any impacts at the decommissioning stage will not be any greater than those during

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		construction and decommissioning phases should be included. "	construction, these impacts were therefore not considered in detail in the ES, as detailed in **Table 9.9**, with justification provided in **Volume A4, Annex 5.1: Impacts Register**.
ERYC Environmental Control Officer (ECO)	29 May 2019 Direct consultation on dispersion modelling via email	The proposed approach to the dispersion modelling, including the roads to be assessed, receptor distances, use of Defra mapped background concentrations, emission factors and meteorological data was considered to be acceptable.	The assessment methodology agreed with ERYC is described in **Section 9.10** (ON-HUM-2.8).
ERYC	04 July 2019 Direct consultation on Impact Register via email	Agreement on the scope and approach to the Impacts Register for Air Quality & Health	The agreement by ERYC that the matters to be scoped in and out was obtained via email (ON-HUM-1.6). The impacts scoped out of the assessment are presented in **Section 9.8.1**.
ERYC	23 September 2019 Section 42 response to PEIR	*"The PEIR is considered a very comprehensive document and includes all the information that the Council would expect to be covered in an Environmental Impact Assessment. [...] When departments have not responded they have indicated that they are happy with the PEIR."*	No specific comments regarding the air quality assessment were received from ERYC. As such, given that the PEIR did not predict any Likely Significant Effects (LSE) on impacts at human receptors within ERYC's area of jurisdiction, no further assessment has been undertaken for the ES. Only impacts on ecological receptors within East Riding of Yorkshire have been further assessed, as detailed in the response from Natural England below (ON-AQ-3.1).
HCC	Telephone meeting on 07 November 2019 and subsequent emails in December 2019	HCC confirmed that the assessment methodology presented within the PEIR was satisfactory. However, HCC requested consideration of a wider study area for the traffic and transport assessment to encompass all major routes into Hull and access to all port areas, with a requirement to assess the associated impact on air quality and noise.	The air quality assessment has considered the wider study area requested by HCC, as described in **Section 9.5**. HCC's SPD requires emissions from a project to be minimised as far as possible to prevent incremental worsening of air quality. A number of refinements

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		HCC also requested consideration of the requirements of its Environmental Quality Supplementary Planning Document (SPD).	were made to the project design between the PEIR and ES stage, which are detailed in Section 9.10.
Natural England	23 September 2019 Section 42 response to PEIR	*"The assessment has failed to assess all of the impacts to designated receptors:* *• There is no assessment of dust from construction to receptors within 200 m (note that Natural England disagrees with the IAQM thresholds for the assessment of air quality on SSSIs);* *• There is no assessment of impacts from NOx (traffic) to receptors;* *• It is unclear how many AADT movements will be made along the haul road and whether this requires assessment (Volume 3, Chapter 7: Traffic and Transport also does not contain this information);* *• The in-combination assessment only includes traffic growth, it does not include other sources (farming/industry etc.)."*	The IAQM mitigation measures committed to by the Applicant will control the effects of dust up to 350 m from construction works (which includes ecological receptors within 200 m, as this is defined in IAQM guidance as the distance over which the greatest impacts are likely to occur (Co144). Impacts on designated sites are therefore still anticipated to be not significant and have not been considered further within the ES. This was agreed with Natural England at the Onshore Ecology Technical Panel Meeting held on the 13th November 2019 (ON-AQ-3.1). Consideration of NOx concentrations at receptors, impacts of Heavy Goods Vehicle (HGV) movements travelling along the haul road and consideration of additional in-combination pollution sources has been provided within the air quality assessment, as detailed in Section 9.10.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
HCC	A technical note was issued by the applicant on 01 May 2020. A telephone meeting was held on 07 May 2020, and subsequent emails in May 2020.	In response to discussions about Traffic and Transport, HCC requested additional information on the air quality assessment methodology and a summary of the assessment findings. Following review of the note, and in response to discussions on Traffic and Transport regarding consideration of traffic flows at sensitive junctions, HCC requested that a commitment be included within the Construction Traffic Management Plan (CTMP) to secure further air quality and noise assessment of potential impacts at sensitive junctions post-consent, once the number and timing of construction vehicles through these junctions is confirmed.	Hornsea Four's commitments include an CoCP (Co124), informed by the outline CoCP, to which an outline Construction Traffic Management Plan (oCTMP) is appended (**Volume F2, Chapter 2: Outline Code of Construction Practice**). The oCTMP covers a pre-construction review of the necessity to undertake additional air quality and noise assessment post-consent (subject to final construction traffic numbers at sensitive junctions), once the construction routes and number of vehicles has been confirmed. The need for these assessments will be agreed with HCC pre-construction.
ERYC and HCC	30 April 2021 Air Quality Position Paper - Data Validity & Next Steps	A position paper was issued to HCC and ERYC which set out the findings of a review of the validity of baseline data used in the assessment, in light of the decision to delay the DCO submission until September 2021. The position paper also set out proposed updates to the air quality assessment to take into account updated air quality assessment tools, changes to baseline and project-generated traffic flows and consideration of the impact of ammonia emissions from road vehicles on designated sites.	HCC confirmed on 25 June 2021 that the contents and approach set out in the Position Paper were acceptable. No response was received from ERYC.

9.5 Study area

9.5.1.1 At the PEIR stage, the Hornsea Four air quality study area was defined as follows:

- Construction and Decommissioning Phase Dust and Particulate Matter Emissions:
- Human receptors within and up to 350 m of the landfall, onshore ECC and OnSS construction works (including temporary access tracks), as defined within Institute of Air Quality Management (IAQM) guidance on the assessment of dust impacts from construction (IAQM, 2016).
- IAQM guidance (IAQM, 2016) states that ecological receptors should be identified within 50 m of construction works; however, ecological receptors within 200 m of the landfall, onshore ECC and OnSS have been identified as requested by Natural England (see **Table 9.6**).
- Construction and Decommissioning Phase Road Traffic Emissions:
- The area within and up to 200 m of roads which are predicted to experience a change in traffic flows above the relevant screening criteria detailed in **Section 9.10**. Due to the rapid drop-off of pollutant concentrations with distance from the road, beyond 200 m the impacts of road traffic emissions are considered to be negligible.

9.5.1.2 The impacts of construction phase dust emissions were found to result in no LSE at the PEIR stage. As such, this impact was not considered further in the ES.

9.5.1.3 At the PEIR stage, the road network included road links within both ERYC and HCC's areas of jurisdiction. The assessment undertaken at the PEIR stage identified no LSE at human receptors within ERYC's administrative area; as such, impacts on human receptors were not considered further in the ES and outlined in **Volume A4, Annex 5.1: Impacts Register**. However, an assessment of impacts on designated ecological sites within ERYC has been undertaken, where roads experience increases in traffic flows above the screening criteria detailed in **Section 9.10**.

9.5.1.4 Given the above, the air quality study area considered in the assessment, presented in **Section 9.11**, largely focusses on the road network within HCC's area of jurisdiction as a result of informal consultation comments received from HCC on the PEIR, as detailed in **Table 9.6**. The air quality study area includes the main trunk roads in the vicinity of the onshore ECC, including the A165, A1033, A1165, A164, A1079 and the A63. The Hull AQMA encompasses part of the A63, which is included in the air quality study area.

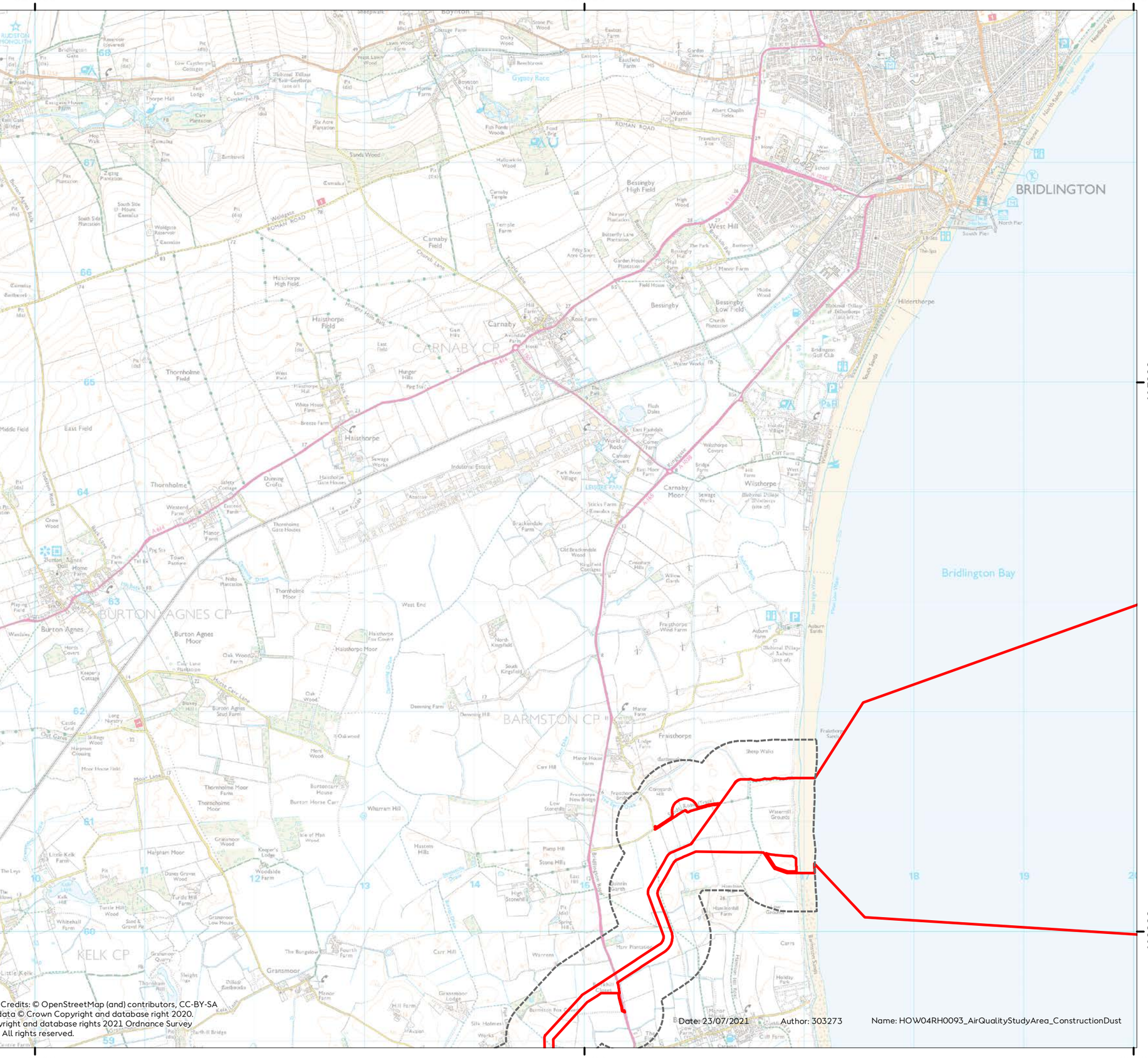
9.5.1.5 The air quality study area is shown in **Figure 9.1** to **Figure 9.6**.

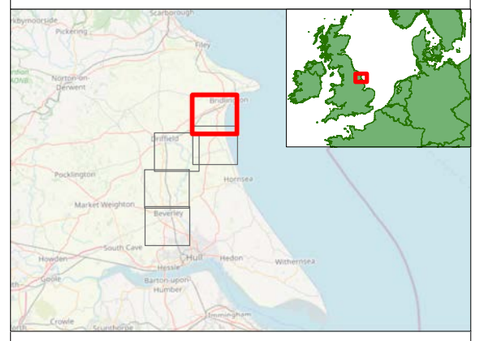
Hornsea Four

Figure 9.1

Air Quality Study Area (Landfall) - Construction Dust Sheet 1

- Order Limits
- Air Quality Study Area - Dust
- Sites of Special Scientific Interest (SSSI)





Coordinate system: British National Grid

Scale@A3: 1:35,000

0 0.5 1 1.5 Kilometres

0 500 1,000 1,500 Yards

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Study Area - Dust
Document no: HOW04RH0093
Created by: AZ
Checked by: CC
Approved by: CS

Royal HaskoningDHV

Ørsted

510000

515000

520000

460000

455000

N

GRID NORTH

River Hull Headwaters SSSI

KELK CP

BEEFORD CP

ULROME CP

SKIPSEA CP

NORTH FRODINGHAM CP

Licenses:
Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA
Contains OS data © Crown Copyright and database right 2020.
© Crown copyright and database rights 2021 Ordnance Survey 0100031673. All rights reserved.

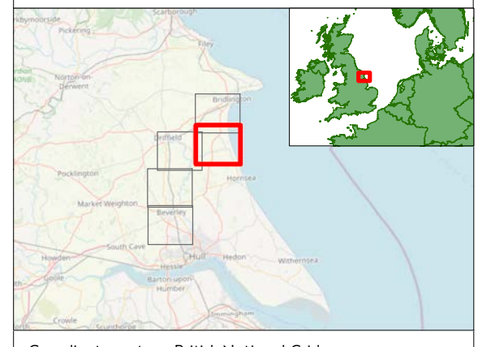
Date: 23/07/2021 Author: 303273 Name: HOW04RH0093_AirQualityStudyArea_ConstructionDust

Hornsea Four

Figure 9.2

Air Quality Study Area (Landfall/ECC) - Construction Dust Sheet 2

- Order Limits
- Air Quality Study Area - Dust
- Sites of Special Scientific Interest (SSSI)



Coordinate system: British National Grid

Scale@A3: 1:35,000

0 0.5 1 1.5 Kilometres

0 500 1,000 1,500 Yards

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Study Area - Dust
Document no: HOW04RH0093
Created by: AZ
Checked by: CC
Approved by: CS

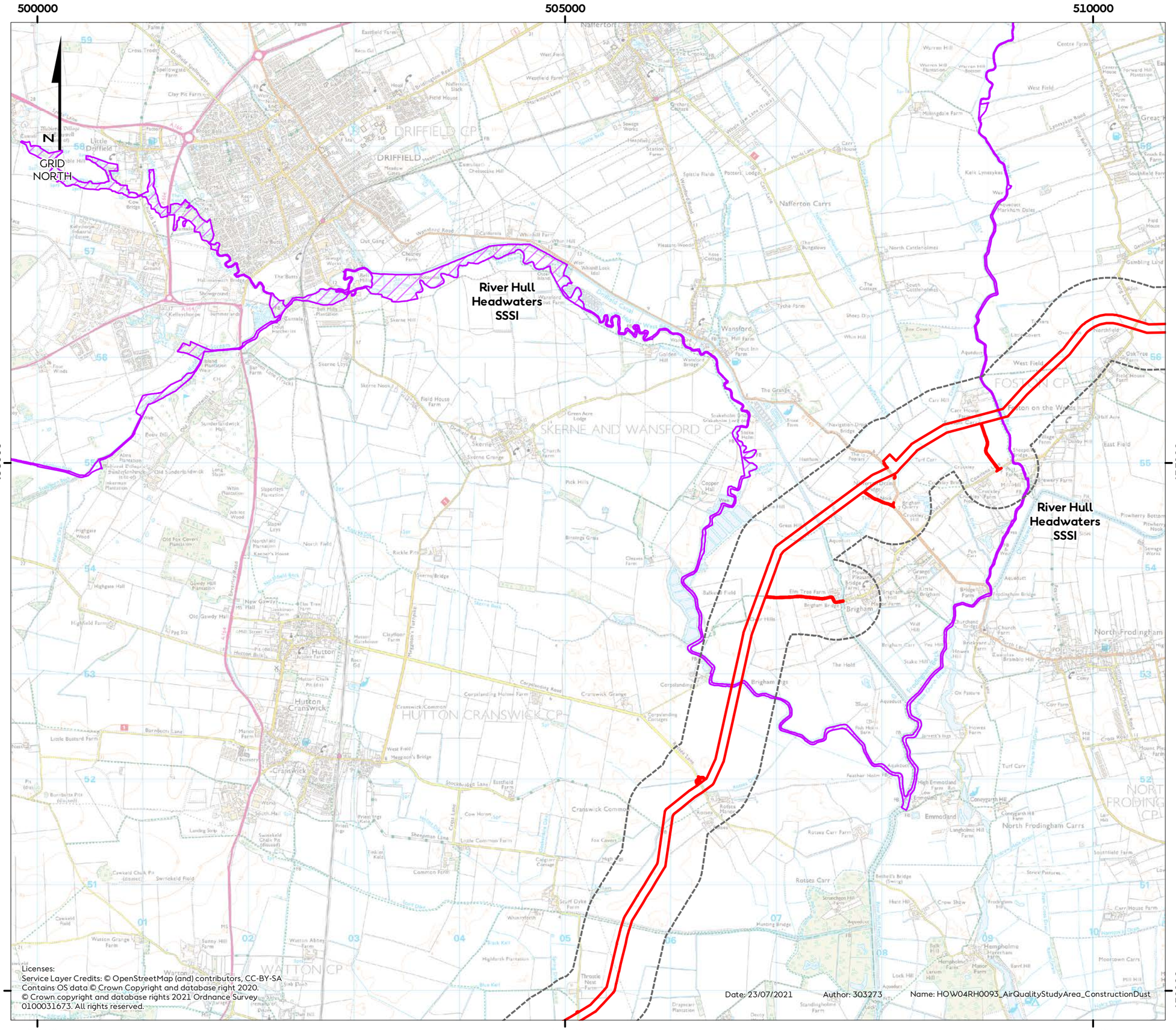
Royal HaskoningDHV

Ørsted

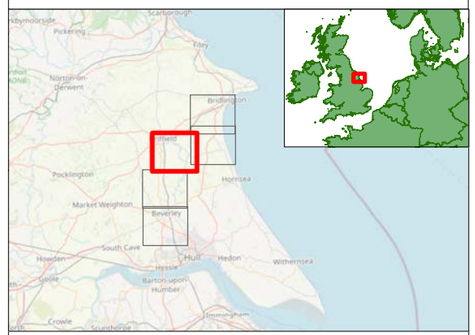
Hornsea Four

Figure 9.3

Air Quality Study Area (ECC)
- Construction Dust Sheet 3



- Order Limits
- Air Quality Study Area - Dust
- Sites of Special Scientific Interest (SSSI)



Coordinate system: British National Grid

Scale@A3: 1:35,000

0 0.5 1 1.5 Kilometres

0 500 1,000 1,500 Yards

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Study Area - Dust
Document no: HOW04RH0093
Created by: AZ
Checked by: CC
Approved by: CS

Royal HaskoningDHV

Ørsted

Hornsea Four

Figure 9.4

Air Quality Study Area (ECC2)
- Construction Dust Sheet 4

500000

505000

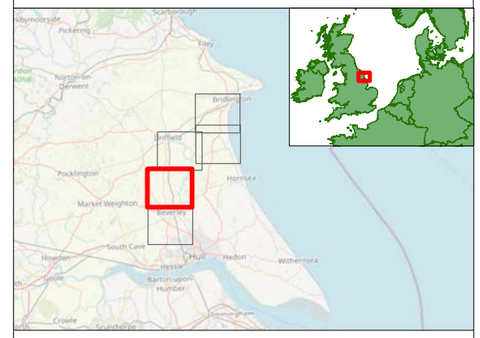
450000

445000

N
GRID
NORTH

Bryan Mills
Field SSSI

- Order Limits
- Air Quality Study Area - Dust
- Sites of Special Scientific Interest (SSSI)



Coordinate system: British National Grid
Scale@A3: 1:35,000

0 0.5 1 1.5 Kilometres

0 500 1,000 1,500 Yards

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Study Area - Dust
Document no: HOW04RH0093
Created by: AZ
Checked by: CC
Approved by: CS

Royal HaskoningDHV

Ørsted

Date: 23/07/2021 Author: 303273 Name: HOW04RH0093_AirQualityStudyArea_ConstructionDust

500000

505000

440000

435000

N

GRID NORTH

Birkhill Wood Ancient Woodland

BEVERLEY

WOODMANSEY CP

WALKINGTON CP

ROWLEY CP

SKIDBY CP

COTTINGHAM CP

Licenses:
Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA
Contains OS data © Crown Copyright and database right 2020.
© Crown copyright and database rights 2021 Ordnance Survey
0100031673. All rights reserved.

Date: 23/07/2021 Author: 303273 Name: HOW04RH0093_AirQualityStudyArea_ConstructionDust

Hornsea Four

Figure 9.5

Air Quality Study Area (ECC/OnSS) - Construction Dust Sheet 5

- Order Limits
- Air Quality Study Area - Dust
- Ancient Woodland

Coordinate system: British National Grid

Scale@A3: 1:35,000

0 0.5 1 1.5 Kilometres

0 500 1,000 1,500 Yards

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Study Area - Dust
Document no: HOW04RH0093
Created by: AZ
Checked by: CC
Approved by: CS

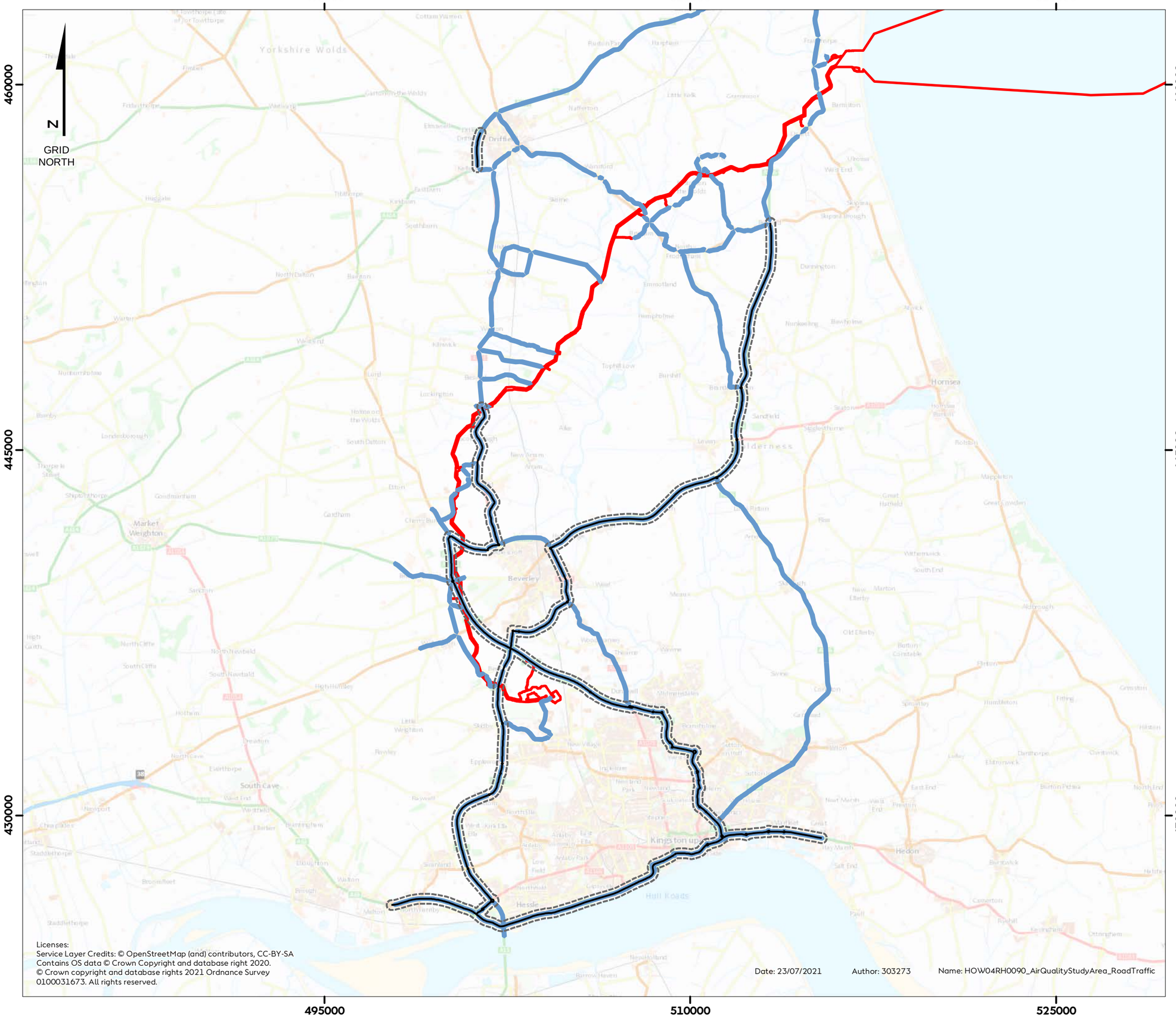
Royal HaskoningDHV

Ørsted

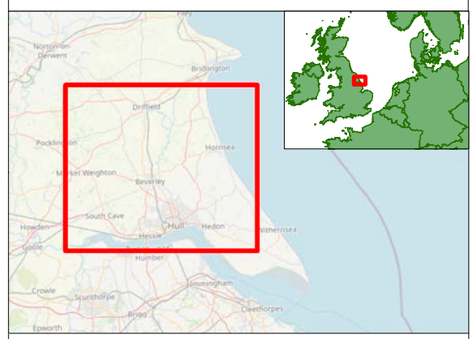
Hornsea Four

Figure 9.6

Air Quality Study Area - Road Traffic



- Order Limits
- 200 m Study Area
- Air Quality Study Area - Roads
- Full Extent of Traffic and Transport Network



Coordinate system: British National Grid

Scale@A3: 1:150,000

0 2 4 8 Kilometres

0 1 2 4 Miles

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Study Area
Document no: HOW04RH0090
Created by: AZ
Checked by: CC
Approved by: CS

Royal HaskoningDHV

Ørsted

9.6 Methodology to inform baseline

9.6.1 Desktop Study

9.6.1.1 A desk study was undertaken to obtain and collate information and data on baseline air quality within the Hornsea Four air quality study area. The sources of information used to obtain this information are presented in Table 9.7.

Table 9.7: Key Sources of Air Quality Data.

Source	Summary	Coverage of Hornsea Four development area
ERYC Air Quality Annual Status Report 2020	Local monitoring data and baseline information	Covers area within ERYC's jurisdiction
HCC Air Quality Annual Status Report 2020	Local monitoring data and baseline information	Outside of Hornsea Four development area but within the air quality study area
Centre for Ecology and Hydrology (CEH) Air Pollution Information System (APIS)	Details of critical loads for ecological habitats	Covers the UK as a whole
Natural England MAGIC habitat mapping tool	Locations of sensitive habitats	Covers the UK as a whole
Defra's LAQM Support Portal	1 x 1 km grid background pollution maps	Covers the UK as a whole

9.6.1.2 Baseline data were obtained for the 2019 assessment year, as this is the most recent full calendar year for which monitoring and meteorological data were available for model verification. Predicted background concentrations for 2024 were used for the future year scenarios, as this is the expected earliest year of construction.

9.6.1.3 The future baseline was not predicted forward to decommissioning, as current air quality predictions are only available up to 2030, whereas the decommissioning of Hornsea Four is anticipated to occur beyond 2050. It is therefore not possible to robustly predict future baseline air quality during decommissioning.

9.6.2 Site Specific Surveys

9.6.2.1 No site-specific surveys were undertaken for air quality. It was agreed during consultation with ERYC (ON-HUM-1.6) that the use of existing monitoring carried out by ERYC was sufficient for use in the air quality assessment (as described in Table 9.6). This approach was also shared with HCC.

9.7 Baseline environment

9.7.1 Existing baseline

9.7.1.1 The existing air quality baseline within the Hornsea Four air quality study area was evaluated using data from publicly available sources, as detailed in **Table 9.7**. The baseline data sources are sufficient to provide an assessment of potential air quality impacts arising from Hornsea Four and were agreed with ERYC and HCC during consultation via email on the 29th May 2019 and in a telephone meeting on the 7th November 2019 respectively.

9.7.1.2 As stated in its Annual Status Report for 2020 (ERYC, 2020), ERYC has not declared any statutory AQMAs within its area of jurisdiction. Recent monitoring data within the ERYC administrative area show that concentrations of NO_2 are below the annual mean Objective at locations of relevant exposure.

9.7.1.3 The air quality study area extends into the jurisdiction of HCC, which has declared a statutory AQMA around the A63 trunk road which runs through the centre of the city (HCC, 2018). Recent air quality monitoring data collected by HCC show that NO_2 concentrations within the AQMA area continue to be above the annual mean Objective in some locations, which is mainly due to road traffic emissions from the A63 trunk road. Furthermore, a row of residential properties to the east of the AQMA, along the A1033 Hedon Road, has also experienced elevated pollutant concentrations in recent years and is therefore an additional area of consideration with regard to air quality. These areas are located within the air quality study area and have therefore been considered within the assessment.

Background Pollutant Concentrations

9.7.1.4 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 Hornsea Four air quality study area (Defra 2020a). The range of background concentrations across the air quality study area are detailed **Table 9.8**.

9.7.1.5 As detailed in Table 9.8, background pollutant concentrations are 'well below', i.e., less than 75% of, the relevant annual mean Objectives. The maximum NO_2 background concentrations occur within the Hull AQMA, which is to be expected in this more urban area where there are a number of pollution sources. Elsewhere in the air quality study area, pollution concentrations are lower, which is to be expected in a predominantly rural area away from localised pollution sources such as roads.

Table 9.8: Background Pollutant Concentrations.

Annual mean background concentration 2019 (µg.m^{-3})					
NO_2		*PM_{10}*		*$PM_{2.5}$*	
Minimum	*Maximum*	*Minimum*	*Maximum*	*Minimum*	*Maximum*
6.66	23.86	14.70	16.61	9.42	10.84
Annual mean NO_2 Objective = 40µg.m^{-3}		Annual mean PM_{10} Objective = 40µg.m^{-3}		Annual mean $PM_{2.5}$ Objective = 25µg.m^{-3}	
Annual mean background concentration 2024 (µg.m^{-3})					
NO_2		*PM_{10}*		*$PM_{2.5}$*	
Minimum	*Maximum*	*Minimum*	*Maximum*	*Minimum*	*Maximum*
5.59	20.99	13.84	15.70	8.72	10.13
Annual mean NO_2 Objective = 40µg.m^{-3}		Annual mean PM_{10} Objective = 40µg.m^{-3}		Annual mean $PM_{2.5}$ Objective = 25µg.m^{-3}	

9.7.1.6 The current baseline description above provides an accurate reflection of the current state of the existing environment. The earliest possible date for the start of construction for the onshore elements of Hornsea Four is 2024 with an anticipated operational life of 35 years and, therefore, there exists the potential for the baseline to evolve between the time of assessment and point of impact. Outside of short-term or seasonal fluctuations, changes to the baseline in relation to air quality usually occur over an extended period of time (considered in **Section 9.7.2**). Based on current information regarding reasonably foreseeable events over the next four years, the baseline environment is not anticipated to have fundamentally changed from its current state at the point in time when impacts occur.

9.7.2 Evolution of the Baseline

9.7.2.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 require that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the ES (EIA Regulations, Schedule 4, Paragraph 3). From the point of assessment, over the course of the development and operational lifetime of Hornsea Four (operational lifetime anticipated to be 35 years), long-term trends mean that the condition of the baseline environment is expected to evolve. This section provides a qualitative description of the evolution of the baseline environment, on the assumption that Hornsea Four is not constructed, using available information and specialist technical knowledge of air quality.

9.7.2.2 The quantity and composition of vehicle emissions is dependent on the type of vehicle, fuel used, engine type, size and efficiency, vehicle speeds and the type of exhaust emissions

abatement equipment employed. It is expected that air quality in Hull will improve over time with the evolution of the vehicle fleet and the use of alternative fuel vehicles, combined with measures implemented by HCC and road improvements implemented by Highways England (now National Highways) to improve air quality within the designated AQMA. As such, it is anticipated that future pollutant concentrations will be reduced from baseline levels, as reflected in the predicted background concentrations provided by Defra, shown in **Table 9.8**.

9.7.3 Data Limitations

9.7.3.1 Diffusion tube monitoring is a standard indicative monitoring method used by local authorities to measure air quality within their administrative areas. Diffusion tubes do not provide the same level of precision and accuracy as automatic monitoring methods; however, good quality assurance and quality control processes will minimise uncertainties insofar as possible. Furthermore, annual mean diffusion tube monitoring results are adjusted for bias using a factor derived using MCerts reference method monitoring equipment. The uncertainties and limitations to monitored air pollution data are therefore unlikely to significantly affect the certainty of the EIA.

9.7.3.2 Background pollutant concentrations within the air quality study area were derived using the pollution maps provided by Defra for 1 km x 1 km grid squares across the UK. These data are derived using an empirical model, calibrated using monitoring data from the UK Automatic Urban and Rural Network and, as such, there are inherent uncertainties associated with modelled data. However, the use of these maps is an industry-standard approach and was agreed with stakeholders during consultation (see **Table 9.6**). Uncertainties in these mapped background values are unlikely to significantly affect the certainty of the EIA and the conclusions of the assessment.

9.7.3.3 The latest version of Defra's air quality assessment tools, including the background pollutant maps, are based on assumptions prior to the Covid-19 pandemic. As such, the tools do not reflect any short or long-term changes to emissions which may have occurred as a result of behavioural change during the pandemic.

9.8 Project basis for assessment

9.8.1 Impact register and impacts not considered in detail in the ES

9.8.1.1 Upon consideration of the baseline environment, the project description outlined in **Volume A1, Chapter 4: Project Description**, the Hornsea Four Commitments (**Volume A4, Annex 5.2: Commitments Register**) and response to formal consultation on the PEIR, several potential impacts upon air quality are "Not considered in detail in the ES". These impacts are outlined, together with a justification for not considering them further, in **Table 9.9** which should be read in conjunction with **Volume A4, Annex 5.1: Impacts Register**.

Table 9.9: Air quality impact register - Impacts not considered in detail in the ES.

Project activity and impact	Likely significance of effect	Approach to assessment	Justification
Emissions from facilities Operation and maintenance of the onshore export cable and onshore substation may affect human and ecological receptors. (AQ-O-4)	No likely significant effect	Scoped Out	Not required as agreement to scope out was achieved during EIA Scoping and no further impacts have been identified. (PINS Scoping Opinion, November 2018, ID:4.21.3).
Dust generation and exhaust emissions from traffic Operation (and maintenance) and decommissioning related traffic will be associated with emissions of dust and exhaust gases, which may affect human and ecological receptors. (AQ-O-3)	No likely significant effect	Not considered in detail in the ES	Impact not considered in detail due to minimal dust and traffic generation during operation. Approach agreed with ERYC (ON-AQ-3.1).
Dust generation Temporary impacts of decommissioning of the OnSS may affect receptors sensitive to dust (human and ecological). (AQ-D-5)	No likely significant effect	Not considered in detail in the ES	Impact not considered in detail due to no LSE being identified at the PEIR stage. No further impacts have been identified and approach was agreed with ERYC (ON-AQ-3.1).
Dust generation Dust raising activities (earthworks, traffic on unpaved areas, construction works) from onshore construction works. This may have an effect on human and ecological receptors sensitive to dust and PM10. (AQ-C-1)	No likely significant effect	Not considered in detail in the ES. No likely significant effect identified at PEIR	The position on dust impacts with regard to designated sites was clarified in the Technical Panel meeting with Natural England on the 13th November 2019, where it was agreed that the project commitments would prevent significant impacts from occurring (ON-AQ-3.1). As no significant effect was identified at PEIR (Orsted 2019), and as no further impacts have been identified, this impact has not been assessed further in

Project activity and impact	Likely significance of effect	Approach to assessment	Justification
			the ES. This approach has been agreed with ERYC (ON-HUM-1.6).
Dust generation and exhaust emissions from traffic Construction-related traffic will be associated with emissions of dust and exhaust gases, which may affect human and ecological receptors. (AQ-A-2a)	Likely significant effect without secondary mitigation	Not considered in detail in the ES. No likely significant effect identified at PEIR	Impacts on human receptors within ERYC's area of jurisdiction showed no LSE at PEIR. As no significant effect was identified at PEIR (Orsted 2019), and as no further impacts have been identified, this impact has not been assessed further in the ES. This approach has been agreed with ERYC (ON-HUM-1.6).

Notes:
Grey - Potential impact is scoped out at EIA Scoping and both PINS and Hornsea Four agree.
Red – Potential impact is not considered in detail in the ES with no consensus between PINS and Hornsea Four at EIA Scoping and further justification provided during the pre-application stage.
Purple - Not considered in detail in the ES. No likely significant effect identified at PEIR.

9.8.2 Commitments

9.8.2.1 The Applicant has adopted commitments (primary design principles inherent as part of Hornsea Four, installation techniques and engineering designs/modifications) as part of its pre-application phase, to eliminate and/or reduce the likely significant effect (LSE) of a number of impacts. These are outlined in **Volume A4, Annex 5.2 Commitments Register**. Further commitments (adoption of best practice guidance), referred to as tertiary commitments in **Table 9.10** below, are embedded as an inherent aspect of the EIA process. Secondary commitments are incorporated to reduce LSE to environmentally acceptable levels following initial assessment i.e., so that residual effects are reduced to environmentally acceptable levels.

9.8.2.2 The commitments adopted by the Applicant in relation to air quality are presented in **Table 9.10**.

Table 9.10: Relevant air quality commitments.

Commitment ID	Measure Proposed	How the measure will be secured
Co49	Primary: There will be no permanent High Voltage infrastructure installed above surface within 110 m of residential properties and sub surface infrastructure (including the onshore export cable) within 50 m of residential properties.	DCO Requirement 7 (Detailed design approval onshore)
Co64	Tertiary: Topsoil and subsoil will be stored in separate stockpiles in line with DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298 or the latest relevant available guidance. Any suspected or confirmed contaminated soils will be appropriately separated, contained and tested before removal (if required).	DCO Requirement 17 (CoCP) DCO Requirement 14 (Contaminated land and groundwater scheme)
Co114	Tertiary: Good practice air quality management measures will be applied where it is relevant human receptors reside within 350 m of works or ecological receptors are present within 200 m, as described in Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction 2014, version 1.1, or latest relevant available guidance.	DCO Requirement 17 (CoCP)
Co124	Tertiary: A Code of Construction Practice (CoCP) will be developed in accordance with the outline CoCP. The outline CoCP will include measures to reduce temporary disturbance to residential properties, recreational users, and existing land users.	DCO Requirement 17 (CoCP)
Co127	Tertiary: An Onshore Decommissioning Plan will be developed prior to decommissioning in a timely manner. The Onshore Decommissioning Plan will include provisions for the removal of all onshore above ground infrastructure and the decommissioning of below ground infrastructure and details relevant to flood risk, pollution prevention and avoidance of ground disturbance. The Onshore Decommissioning Plan will be in line with the latest relevant available guidance.	DCO Requirement 24 (onshore decommissioning)
Co134	Primary: Cable installation works at the landfall area will be located at least 200 m from residential receptors.	DCO Works Plan – Onshore
Co135	Primary: Temporary construction highway access points along the onshore export cable corridor (ECC) will be located at least 150 m from residential receptors, with the exception of three receptors: Bridge Farm Holiday Cottages; Arms Farm and Elm Tree Farm, in Brigham, Driffield.	DCO Requirement 18 (Construction traffic management plan)

9.9 Maximum design scenario

9.9.1.1 This section describes the parameters on which the air quality assessment has been based. These are the parameters which are judged to give rise to the maximum levels of effect for the assessment undertaken, as set out in **Volume A1, Chapter 4: Project Description**. Should Hornsea Four be constructed to different parameters within the design envelope, then impacts will not be any greater than those set out in this ES using the MDS presented in **Table 9.11**.

Table 9.11: Maximum design scenario for impacts on air quality.

Impact and Phase	Embedded Mitigation Measures	Maximum Design Scenario / Rochdale Envelope	Justification
Construction			
Dust generation Dust raising activities (earthworks, traffic on unpaved areas, construction works) from onshore construction works. This may have an effect on human and ecological receptors sensitive to dust and PM_{10}. (AQ-C-1)	Primary: Co133 Co134 Co135 Tertiary. Co64 Co114 Co124	**Landfall:** • Construction duration: 32 months • Landfall compound: Number: 1, Total Area: 40,000 m^2, Duration: 32 months • HDD: Number: 8 **Onshore Export Cable Corridor:** • Construction duration: 30 months • Logistics compounds: Number: 1 primary, Size: 140 x 140 m; 7 secondary, Size 90 x 90 m. Duration: 36 months • ECC: Length: 40 km (approximate), Width: 80 m, Area: 3,200,000 m^2 • Number of cable circuits: 6 • Cable trench: Depth: max 1.5 m, Width at base: 1.5 m, Width at surface: 5m • HDDs: Number: 112, HDD compounds (entry and exit): 224 70 x 70 m compounds, Duration of HDD Compound: 1 month each • Haul Road: Number: 1, Width: 6 m (with 7 m passing places), Length: 37 km, Maximum Depth: 1 m, Average Depth: 0.4 m • Temporary access roads: Width: 6 m (with 7 m passing places), Total combined length (excluding existing paved sections): 5.1 km, Depth: 0.4 m **Onshore Substation and Energy Balancing Infrastructure:** • Construction duration: 43 months • Permanent infrastructure area: 164,000 m^2 • Temporary works area: 130,000 m^2	This would represent the greatest dust generation potential which may affect the receptors within the air quality study area. A number of MDSs include additional contingency. Landfall would be selected based on the two landfall options presented in **Volume 1, Chapter 4: Project Description**. Commitments include good-practise dust management methods in accordance with IAQM guidance (IAQM, 2014).

Impact and Phase	Embedded Mitigation Measures	Maximum Design Scenario / Rochdale Envelope	Justification
		400 kV ECC: • Number of cable circuits: 4 • Cable trench depth: 1.5 m • Length: 2,100 m, Width: 60 m.	
Road traffic exhaust emissions (AQ-A-2b)	Primary: Co36 Tertiary: Co124 Co144	The maximum Annual Average Daily Traffic (AADT) movements generated by Hornsea Four is 584 total vehicles, of which 325 are Heavy Duty Vehicles (HDVs). The derivation of the construction flows has been carried out as part of the Traffic and Transport assessment on behalf of the Applicant in accordance with the MDS for Traffic and Transport. Refer to Impact ID TT-C-2 to TT-C-8 (see **Chapter 7: Traffic and Transport**).	Establishing the maximum daily vehicle movements (as Annual Average Daily Traffic (AADT) flows) and routes taken by construction traffic along which impacts at receptors may occur. The AADT traffic flows generated by Hornsea Four during construction are detailed in **Table 9.13** and **Table 9.14.**
Operation			
Scoped out of assessment			
Decommissioning			
Scoped out of assessment			

9.10 Assessment methodology

9.10.1.1 The assessment methodology for air quality is consistent with that presented in Annex C of the Hornsea Four Scoping Report (Orsted 2018) and subsequent consultation feedback (**Section 9.4**).

9.10.1.2 The terminology and impact assessment methodologies used in this chapter differ from the Design Manual for Roads and Bridges (DMRB) impact assessment terminologies presented within **Volume A1, Chapter 5: EIA Methodology**, as air quality guidance documents include specific assessment impact criteria, as described in the sections below.

9.10.2 Impact assessment criteria

Construction Phase Road Traffic Exhaust Emissions

9.10.2.1 The requirement for a detailed assessment of construction vehicle exhaust emissions at human receptors was considered using screening criteria provided by the IAQM and Environmental Protection UK (EPUK) (IAQM and EPUK 2017). Natural England guidance on the assessment of road traffic impacts on designated ecological sites (Natural England, 2018) references the screening criteria contained in the DMRB guidance (Highways England, 2019); as such, these criteria were used to screen the potential for ecological impacts. The criteria are detailed in **Table 9.12**.

Table 9.12: IAQM and EPUK and DMRB road traffic assessment criteria.

Guidance document	Criteria	
IAQM and EPUK	Light Duty Vehicles (LDVs)	A change in AADT of more than 100 within or adjacent to an AQMA, or more than 500 elsewhere
	HGVs	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
	HGVs	An increase in HGV movements of 200 per day or more

9.10.2.2 Impacts predicted at PEIR within ERYC's area of jurisdiction were assessed as no LSE for air quality. As such, impacts at human receptors in this area have not been reconsidered for the ES, as described in **Table 9.9**.

9.10.2.3 With regard to the impact of road traffic on designated ecological sites, the screening criteria from the DMRB (Highways England, 2019) are considered by Natural England to

equate to a 1% change in the Critical Load (CL) or Level (Natural England, 2018) which is regarded as a threshold of insignificance. As such, these criteria were used to screen the potential for impacts at ecological receptors, as agreed by Natural England (ON-ECO-3.6).

9.10.2.4 Following consultation on the PEIR, further work was requested by Natural England with regard to impacts on designated ecological sites and 'in-combination' impacts, within both ERYC and HCC's areas of jurisdiction. In addition, HCC requested consideration of a wider transport study area and additional human receptors for air quality. As such, the assessment presented in this chapter focusses on these aspects only.

9.10.2.5 Traffic flows were screened using the criteria detailed in **Table 9.12,** and the road links considered in the assessment are detailed in **Table 9.13**. It can be seen that links 44 and 86 do not exceed the screening criteria detailed in **Table 9.12** as a result of Hornsea Four alone, however they were assessed due to the 'in-combination' impact on designated ecological sites (**Section 9.14**).

9.10.2.6 The traffic flows were reduced by up to 95 HDV AADT movements between the PEIR and ES stages due to refinements to the project design. The key changes include:

- A reduction in the area of hardstanding required in the secondary logistics compounds;
- A reduction in the average depth of stone required for the landfall compound;
- A reduction in the average depth of the haul road and temporary access roads; and
- A reduction in the stone and concrete slab used at joint bays.

9.10.2.7 The full road network considered in the assessment is described in Volume A6, Annex 7.1: Traffic and Transport Technical Report and shown on **Table 9.6**.

Table 9.13: Road links screened into the assessment.

Link ID	Road Name	Annual Average Daily Traffic (AADT) Flow generated by Hornsea Four During Construction	
		All Vehicles	*HGVs*
44	A164 south of Station Road	416	85
82	A63 from the A15 to A1166	325	325
86	A614 east of Driffield	72	28
91	A63 from the A1166 to Ferensway	325	325
92	A63 from the Ferensway to A1165	325	325
93	A1033 east of the A1165	337	325
94	A1165 Mount Pleasant	335	325
95	A1165 Holwell Road	541	325
96	A1033 Sutton Road	556	325
97	A1033 Thomas Clarkson Way	550	325
98	A1033 Raich Carter Way	584	325

9.10.2.8 Following consultation on the PEIR, Natural England also requested consideration of potential impacts on designated ecological sites as a result of HGVs travelling along the haul road (detailed in **Table 9.6**). The daily number of vehicles travelling along the haul road was calculated where the DCO Order Limits are within 200 m of a designated ecological site, as described in **Section 9.5** and detailed in **Table 9.14**.

Table 9.14: Traffic flows on the haul road within 200 m of a designated ecological site.

Section of Export Cable Corridor	Designated Site Within 200 m	Annual Average Daily Traffic (AADT) Flow generated by Hornsea Four During Construction	
		LGVs	*HGVs*
Between Access Point (AP) AP_009 and AP_010	River Hull Headwaters SSSI	102	25
Between AP_006 and AP_039	River Hull Headwaters SSSI	102	19
Between AP_016 and AP_015	Bryan Mills Field SSSI	102	20
Between A1079 and AP_025 and between A164 and AP_026	Birkhill Wood Ancient Woodland	602	141

9.10.2.9 As shown above, the number of vehicles travelling along the haul road do not exceed the DMRB screening criteria detailed in **Table 9.12**. As such, impacts on designated ecological sites as a result of haul road traffic were not considered further in the assessment as they are considered to be insignificant. Further information is provided in **Chapter 3 Ecology and Nature Conservation**.

Human Receptors

9.10.2.10 The sensitivity of an individual human receptor is not considered in the assessment of air quality impacts; the air quality Objectives in **Table 9.4**, which are health-based, only apply at locations where there is relevant public exposure as detailed in **Table 9.15**.

Table 9.15: Examples of where the Air Quality Objectives should and 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

Averaging period	Objectives should apply at:	Objectives should generally not apply at:
		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.

9.10.2.11 With regard to impact magnitude, receptor locations where pollutant concentrations are close to, or in exceedance of the Objectives, are judged as receiving a larger impact magnitude with a relatively small change in pollutant concentrations, than those locations where there is a more adequate available headroom below the Objective. This is set out in more detail below.

9.10.2.12 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 road traffic-based developments. These criteria, as detailed below, were utilised in the assessment to provide consideration of the impacts associated with Hornsea Four during the construction phase.

9.10.2.13 The impact descriptors that take account of the magnitude of changes in pollutant concentrations, and the concentration in relation to the Air Quality Objectives (HMSO 2000), are detailed in **Table 9.16**.

Table 9.16: 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

9.10.2.14 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 should consider the:

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

9.10.2.15 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 development on local air quality was undertaken by members of the IAQM and IEMA.

9.10.2.16 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

9.10.2.17 HCC provides guidance on determining the significance of a development's impact on air quality in its Environmental Quality SPD (HCC 2019), and notes that it should be a two-stage process. The SPD states that the first stage is based on the conclusions of the air quality assessment and the significance of impacts determined by the assessors using relevant guidance. The second stage in the process is the recommendations made by the relevant local authority officer. HCC's objectives are to ensure the air quality Objectives are met and improve air quality in Hull. Any developments which would undermine the Hull Local Air Quality Action Plan (HCC undated) or Air Quality Strategy (HCC 2017b), lead to any breaches of air quality Objectives, cause increases in relevant pollutant concentrations within the AQMA, or lead to the creation of a new AQMA would be regarded as significant. Mitigation measures would then be required.

Ecological Receptors

9.10.2.18 Where National Site Network sites (i.e., internationally designated sites) are considered, this chapter details the assessments made on the interest features of internationally designated sites as described within **Section 9.11.1** of this chapter (with the assessment on the site itself contained within **Volume B2, Chapter 2: Hornsea Four Report to Inform Appropriate Assessment** (RIAA)).

9.10.2.19 With respect to nationally and locally designated sites, where these sites fall within the boundaries of an internationally designated site (e.g., SSSIs within a National Site Network site), only the international site has been taken forward for assessment. This is because potential effects on the integrity and conservation status of the nationally designated site are assumed to be inherent within the assessment of the internationally designated site (i.e., a separate assessment for the national site is not undertaken). However, where a nationally designated site falls outside the boundaries of an international site, but within the air quality study area, an assessment of the impacts on the overall site is made in this chapter using the methodology set out in this chapter.

9.10.2.20 Critical loads for habitat sites in the UK are published on the Air Pollution Information System (APIS) website (CEH 2021). These are the maximum levels of nutrient nitrogen and acid deposition that can be tolerated without increasing the risk of harm to the most sensitive features of these habitat sites.

9.10.2.21 Natural England considers that, where the contribution of a project leads to deposition or pollutant concentration values below 1% of the Critical Load or Level, impacts can be considered to be not significant (Natural England 2018). Natural England notes that for traffic-related impacts, this equates to a 1,000 AADT or 200 HGV increase in traffic flows. This is considered to be a reasonable determination of the level at which impacts of a project or plan are not significant (Natural England 2018). A change of this magnitude is likely to be within the natural range of fluctuations in deposition and is unlikely to be perceptible.

9.10.2.22 A project or plan in isolation may not lead to significant effects, however the EIA Regulations require the consideration of impacts associated with a project or plan both in isolation, and in addition to other plans or projects which may affect the same designated site (an 'in-combination' assessment). The outcome of court judgements (notably the Wealden Judgement 2017) has led to the requirement for the 1% criterion to be applied to the in-combination impact to determine whether impacts remain insignificant, or whether further ecological investigation is required (**Section 9.14**).

9.10.2.23 The road links which pass alongside the designated sites considered in the assessment (as detailed in **Table 9.23**) will experience background traffic growth between the base year (2019) and the year of peak construction (2024), which will increase nutrient nitrogen deposition at the designated sites. The 1,000 AADT threshold was therefore applied to the 'in-combination' traffic flows (project-generated traffic flows plus background growth) to determine whether a detailed assessment was required.

9.10.2.24 In addition, any consented agricultural or industrial projects in the vicinity of designated sites which may be affected by traffic generated by Hornsea Four may also contribute to nutrient nitrogen and acid and NOx and ammonia concentrations. Natural England developed SSSI Impact Risk Zones (IRZs) which specify the types of projects which may impact on SSSIs based on the distance from the site, as shown in **Table 9.17**.

Table 9.17: Natural England's SSSI Impact Risk Zones.

Distance from Designated Site	0 – 0.5 km	0.5 - 2 km	3 – 5 km
Proposals, permissions and permits	Any development that could cause air pollution (including industrial/commercial processes, livestock & poultry units, slurry lagoons/manure stores).	Any industrial/agricultural development that could cause air pollution (including industrial processes, livestock & poultry units with floorspace > 500m², slurry lagoons > 200m² & manure stores > 250t).	Any industrial/agricultural development that could cause air pollution (including industrial processes, livestock & poultry units with floorspace > 500m², slurry lagoons > 750m² & manure stores > 3500t).

9.10.2.25 Where the 'in-combination' traffic flows exceeded 1,000 AADT, a search was carried out for projects within the relevant distances which met the above criteria. Additional contributions of nutrient nitrogen from these sources (from both NO_2 and ammonia) and airborne NOx and ammonia were included in the 'in-combination' assessment, where there was sufficient information included within the application to quantify these emissions (**Section 9.12**).

9.10.2.26 This approach to the assessment is also in accordance with the requirements of IAQM Guidance on the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (IAQM 2020).

9.10.2.27 Any development-generated or in-combination nutrient nitrogen deposition values above 1% of the Critical Load would require additional assessment by an ecologist to determine whether any significant impacts may be experienced at the affected habitats. The determination of the significance of impacts associated with nutrient nitrogen and acid deposition and airborne NOx and ammonia concentrations is detailed in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** (with the assessment on the site itself contained within the Hornsea Four RIAA (**Volume B2, Chapter 2: Report to Inform Appropriate Assessment**)) for the River Humber SAC, Special Protection Area (SPA) and SSSI. Impacts on the Bryan Mills Field SSSI and River Hull Headwaters SSSI are detailed in **Chapter 3: Ecology and Nature Conservation**.

9.10.3 Dispersion Modelling

9.10.3.1 The air quality assessment was carried out using dispersion modelling. Specific details of the dispersion modelling methodology were agreed in consultation with ERYC as part of the

Evidence Plan process (ON-HUM-1.6), and subsequently with HCC as a response to PEIR consultation, as described in **Table 9.6**.

9.10.3.2 The potential impact of exhaust emissions from construction vehicles accessing the landfall, onshore ECC and OnSS, on the road links exceeding the assessment screening criteria (see **Table 9.13**) was assessed using the Atmospheric Dispersion Modelling System for Roads (ADMS-Roads) v5.0.0.1. The main pollutants of concern for human health as a result of vehicle emissions are annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$. For ecological receptors, the pollutants of concern are NO_x, NO_2 and ammonia. Concentrations of these pollutants were therefore the focus of the ADMS-Roads assessment.

9.10.4 Assessment Scenarios

9.10.4.1 The onshore construction works are expected to occur over an approximately three-year period, from 2024 at the earliest to 2027. To provide a conservative assessment, the maximum project-generated traffic across the construction period was combined with the earliest year of construction, where pollutant emission rates and background concentrations would be higher than in later years of construction. These peak construction traffic flows were used to derive a representative AADT for the purposes of the air quality assessment. The assessment has therefore considered the following scenarios:

- Verification / Base year (2019);
- MDS Construction Year (2024) 'without project'; and
- MDS Construction Year (2024) 'with project'.

9.10.4.2 A base year of 2019 was used as this was the most recent full calendar year for which monitoring and meteorological data were available.

9.10.5 Traffic Data

9.10.5.1 24-hour AADT flows and HGV percentages were provided by the EIA project team's transport specialists. The traffic data used in the assessment is detailed in **Table 9.18**.

Table 9.18: Traffic data used in the air quality assessment.

Link ID	Road Name	2019 Base Year		2024 Without Hornsea Four		2024 With Hornsea Four	
		AADT Flow	*% HGV*	*AADT Flow*	*% HGV*	*AADT Flow*	*% HGV*
44	A164 south of Station Road	8,743	2%	9,363	2%	9,779	3%
82	A63 from the A15 to A1166	62,151	10%	67,235	10%	67,560	10%
86	A614 east of Driffield	14,430	7%	15,453	7%	15,525	7%
91	A63 from the A1166 to Ferensway	55,728	9%	60,287	9%	60,612	10%
92	A63 from the Ferensway to A1165	41,906	11%	45,334	11%	45,659	12%
93	A1033 east of the A1165	38,808	11%	41,982	11%	42,319	12%
94	A1165 Mount Pleasant	18,330	7%	19,829	7%	20,164	8%
95	A1165 Holwell Road	24,145	8%	26,120	8%	26,662	9%
96	A1033 Sutton Road	18,997	4%	20,551	4%	21,107	6%
97	A1033 Thomas Clarkson Way	18,997	4%	20,551	4%	21,101	6%
98	A1033 Raich Carter Way	17,287	4%	18,701	4%	19,285	6%

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

- Queues were modelled at junctions and the approach to roundabouts at 20 km/h; and
- Speed data for free-flowing traffic conditions were obtained from average speeds recorded during the traffic count surveys where applicable, or national speed limits.

9.10.6 Emission Factors

9.10.6.1 Emission factors for NO_x, PM_{10} and $PM_{2.5}$ were obtained from the Emission Factor Toolkit v10.1 provided by Defra (Defra 2020b). Emission factors for 2019 were used in the 'verification / base year' scenario, and for 2024 in the 'without project' and 'with project' scenarios.

9.10.6.2 Ammonia is emitted from road vehicles as a by-product of systems to reduce NO_x emissions. Whilst ammonia is not a pollutant of concern for human health, it can impact upon designated ecological sites. Defra does not provide vehicle emission factors for ammonia; however, Air Quality Consultants has undertaken research on ammonia emissions from roads (Air Quality Consultants 2020a) and has developed a spreadsheet tool (Calculator for Road Emissions of Ammonia (CREAM)) which provides ammonia emission factors for use in dispersion modelling (Air Quality Consultants, 2020b). Emission factors from the CREAM tool were used in the assessment, for the appropriate assessment years as detailed above.

9.10.7 Meteorological Data

9.10.7.1 2019 meteorological data from the Leconfield recording station was used in the ADMS-Roads model. This is the closest meteorological station as it is within the air quality study area.

9.10.8 Model Verification

9.10.8.1 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 2018) and IAQM and EPUK (IAQM and EPUK 2017) guidance.

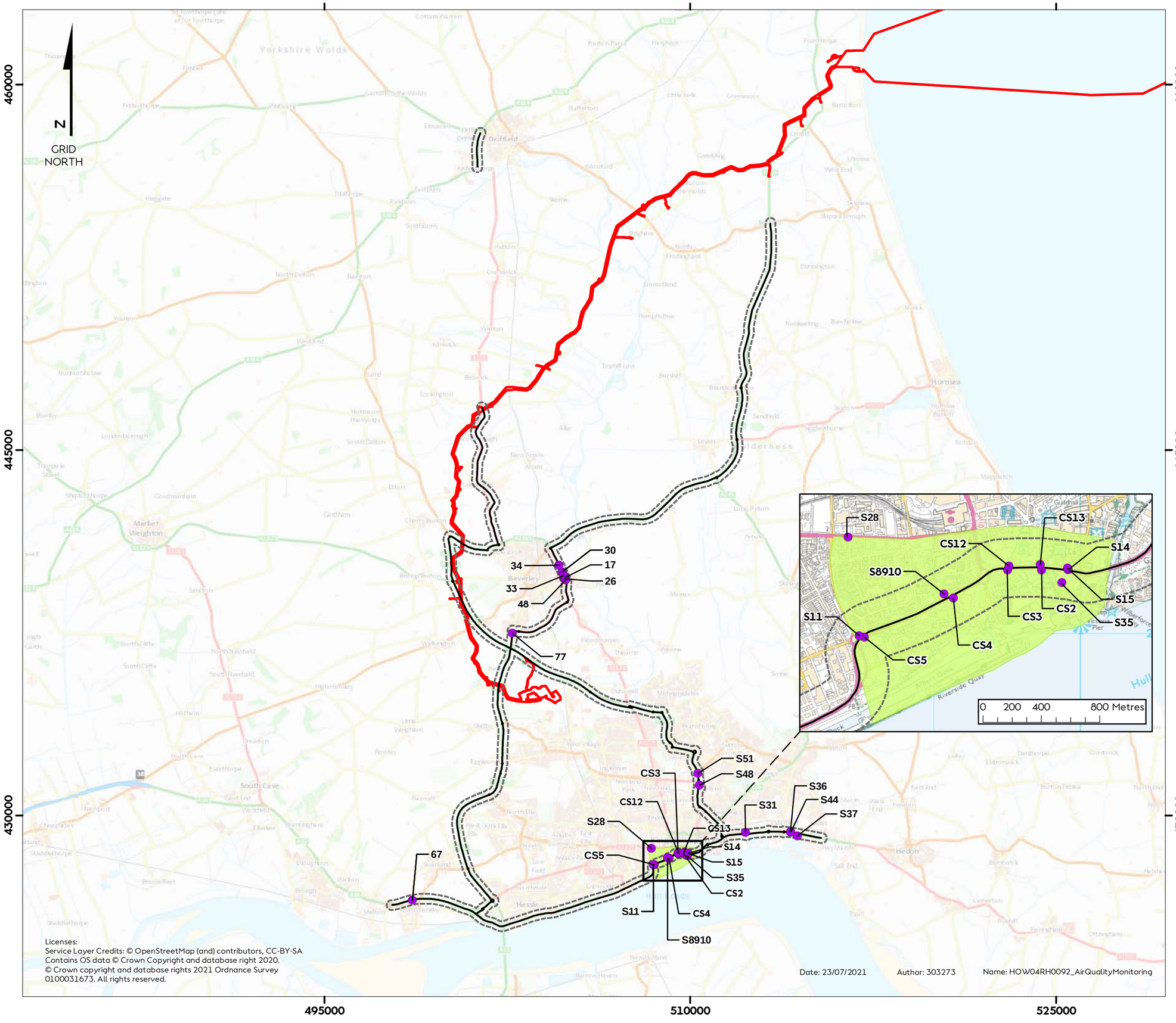
9.10.8.2 Monitoring locations within the Hornsea Four air quality study area were reviewed to establish the suitability for use in model verification for NO_2 and PM_{10}. Locations were considered where the assessed road links provided sufficient representation of road traffic sources that would affect monitored concentrations at that point. Predicted concentrations of ammonia were not verified as, as noted by Air Quality Consultants there are limited robust local measurements of roadside and background ammonia concentrations across the UK (Air Quality Consultants 2020a). As such, in the development of the ammonia emission factors, Air Quality Consultants performed verification of the derived emission rates (Air Quality Consultants 2020a), and therefore further adjustment was not carried out.

9.10.8.3 Two separate model adjustment factors were derived to represent the difference in local conditions within the city of Hull and East Riding of Yorkshire which is more rural or suburban in nature. The model input parameters (e.g., surface roughness) were also adjusted for each area to take account of these variations. The monitoring locations are presented in **Figure 9.7**.

Hornsea Four

Figure 9.7

Air Quality Monitoring and Air Quality Management Area



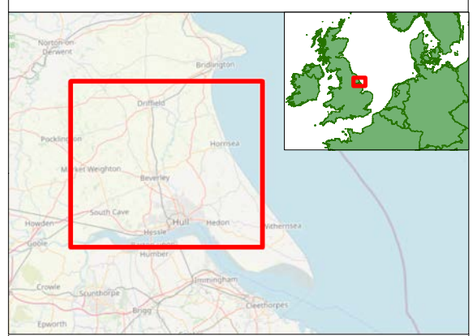
Order Limits

200 m Study Area

Air Quality Study Area - Roads

Kingston-upon-Hull City Council Air Quality Management Area (AQMA)

Monitoring Locations



Coordinate system: British National Grid

Scale@A3: 1:150,000

0 2 4 8 Kilometres

0 1 2 4 Miles

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Monitoring and Air Quality Management Area
Document no: HOW04RH0092
Created by: AZ
Checked by: CG
Approved by: CS

Royal HaskoningDHV

Ørsted

Date: 23/07/2021 Author: 303273 Name: HOW04RH0092_AirQualityMonitoring

Hull verification

9.10.8.4 A review of the monitoring data identified 13 NO_2 diffusion tubes and one continuous analyser within Hull located on the road network under consideration which were suitable for use in the verification process.

9.10.8.5 Three further NO_2 diffusion tubes were identified adjacent to the road network but were not considered for the verification process. The grid reference for diffusion tube S37 did not match the location specified in the Annual Status Report (HCC 2020) and, therefore, this site could not be used for verification. Furthermore, diffusion tubes CS5 and CS11 are located adjacent to roads for which traffic data were not available, and the A63 Castle Street is elevated at this point. These locations were therefore also not included in the verification process, as the dispersion model would not be able to replicate monitored concentrations at these sites.

9.10.8.6 Adjustment of modelled oxides of nitrogen (NOx) concentrations was undertaken using 2019 monitoring data at the identified 13 NO_2 diffusion tubes and one continuous analyser. The model verification process for NOx within the Hull AQMA is detailed in **Table 9.19**.

Table 9.19: Model Verification for NO_2 – Hull.

Model verification	NO_2 monitoring location													
	CS2	*CS3*	*CS4*	*CS12*	*CS13*	*S8910*	*S14*	*S15*	*CM1*	*S31*	*S36*	*S48*	*S51*	*S44*
2019 Monitored Total NO_2 (μ g.m^{-3})	26	42	31	36	37	25	36	32	26	24	37	35	38	30
2019 Background NO_2 (μ g.m^{-3})	20.70	20.70	20.70	20.70	20.70	20.70	20.70	20.70	20.70	18.22	23.86	17.80	17.80	23.86
Monitored Road Contribution NOx (total - background) (μ g.m^{-3})	10.21	44.18	20.29	30.84	33.01	8.25	30.84	22.36	10.21	11.04	26.59	34.53	41.13	12.03
Modelled Road Contribution NOx (excludes background) (μ g.m^{-3})	12.97	24.45	22.62	25.37	23.31	10.76	31.66	17.33	10.76	11.60	23.18	14.05	23.09	15.23
Ratio of Monitored Road Contribution NOx / Modelled Road Contribution Nox	0.8	1.8	0.9	1.2	1.4	0.8	1.0	1.3	0.9	1.0	1.1	2.5	1.8	0.8
Adjustment Factor for Modelled Road Contribution	1.26888													
Adjusted Modelled Road Contribution NOx (μ g.m^{-3})	16.46	31.03	28.71	32.19	29.58	13.66	40.18	21.99	13.66	14.71	29.42	17.83	29.30	19.33
Modelled Total NO_2 (based on empirical NOx / NO_2 relationship) (μ g.m^{-3})	29.13	36.09	35.01	36.62	35.41	27.74	40.24	31.82	27.74	25.86	38.31	27.01	32.56	33.57
Monitored Total NO_2 (μ g.m^{-3})	26	42	31	36	37	25	36	32	26	24	37	35	38	30
% Difference [(modelled - monitored) / monitored] x 100	12.0	-14.1	12.9	1.7	-4.3	11.0	11.8	-0.6	6.7	7.8	3.5	-22.8	-14.3	11.9

9.10.8.7 As shown in **Table 9.19**, the NOx verification process within the Hull AQMA highlighted that model performance varied at the monitoring locations considered. Some locations had very low monitored road NOx concentrations following the removal of background NO_2, which resulted in the model overpredicting the road contribution in these locations. Urban background monitoring carried out by HCC at the Hull Freetown continuous analyser recorded an annual mean NO_2 concentration of 22 $\mu g.m^{-3}$ in 2019, which shows a good agreement with the Defra mapped background concentrations used in the assessment, particularly within the AQMA. Therefore, total monitored NO_2 concentrations at these diffusion tubes are likely to be dominated by background pollution sources.

9.10.8.8 The Root Mean Square Error (RMSE) of the model was 4 $\mu g.m^{-3}$ (10% of the Objective), which is within the ideal value of 10% of the Objective as specified in Defra guidance (Defra 2018). However, the model underpredicted NO_2 concentrations at three diffusion tubes which were above or approaching the Objective in 2019 (CS3, CS13 and S51) and, as a consequence, the derived adjustment factor detailed in **Table 9.19** would underestimate pollutant concentrations at these sensitive locations.

9.10.8.9 To represent the model performance at the most sensitive location, the ratio of monitored to modelled NOx concentrations recorded at diffusion tube CS3 (1.8), located within the AQMA and which recorded an annual mean NO_2 concentration in exceedance of the Objective in 2019, was applied to modelled concentrations at all sensitive receptors within HCC's area of jurisdiction. This approach to the assessment methodology was shared with HCC.

9.10.8.10 Verification of modelled PM_{10} concentrations was carried out using the continuous analyser CM1, located within the Hull AQMA. The PM_{10} verification process is detailed in **Table 9.20**.

Table 9.20: Model Verification for PM_{10} – Hull.

Model verification	PM_{10} Monitoring Location
	CM1
2019 Monitored Total PM_{10} (μ $g.m^{-3}$)	16
2019 Background PM_{10} (μ $g.m^{-3}$)	15.97
Monitored Road Contribution PM_{10} (total - background) (μ $g.m^{-3}$)	0.03
Modelled Road Contribution PM_{10} (excludes background) (μ $g.m^{-3}$)	1.23
Ratio of Monitored Road Contribution PM_{10} / Modelled Road Contribution PM_{10}	0.03
Adjustment Factor for Modelled Road Contribution	0.02770
Adjusted Modelled Road Contribution PM_{10} (μ $g.m^{-3}$)	0.03
Modelled Total PM_{10} (μ $g.m^{-3}$)	16
Monitored Total PM_{10} (μ $g.m^{-3}$)	16

9.10.8.11 As shown in Table 9.20, the monitored road component was very low in 2019. Background concentrations of PM_{10} typically do not reduce at the same rate as emissions of NO_2, as improvements in NO_2 concentrations are primarily achieved by more stringent emission standards, whereas there are other sources of PM_{10} (e.g., natural sources, brake and tyre wear) which are not affected by emission reduction measures. Furthermore, there is no background PM_{10} monitoring undertaken within HCC's area of jurisdiction to determine the representativeness of the Defra mapped background concentrations.

9.10.8.12 As the derived PM_{10} verification factor was less than 1, no adjustment to modelled concentrations was carried out, which is considered to provide a conservative assessment.

9.10.8.13 There is no roadside $PM_{2.5}$ monitoring carried out within HCC's area of jurisdiction to carry out verification of the $PM_{2.5}$ model outputs. Therefore, the same approach was taken for $PM_{2.5}$ concentrations as PM_{10}.

ERYC verification

9.10.8.14 A review of the monitoring data identified eight NO_2 diffusion tubes within ERYC's area of jurisdiction, of which five which were suitable for use in the verification process.

9.10.8.15 Two diffusion tubes, sites 26 and 48, were not included in the model verification process, as they are located on a complex roundabout which could not be replicated in the dispersion model using the traffic data available. A further diffusion tube, location 67, was excluded from the verification process as it is situated atop a road cutting which could not be accurately represented within the dispersion model.

9.10.8.16 The model verification process for the air quality study area within the ERYC's jurisdiction is detailed in Table 9.21.

Table 9.21: Model Verification for NO_2 – ERYC area.

Model Verification	NO_2 Monitoring Location				
	17	*30*	*33*	*34*	*77*
2019 Monitored Total NO_2 (μ g.m^{-3})	29	23	29	17	25
2019 Background NO_2 (μ g.m^{-3})	10.44	10.44	10.44	10.31	9.35
Monitored Road Contribution NOx (total - background) (μ g.m^{-3})	36.09	23.79	36.09	12.36	29.9
Modelled Road Contribution NOx (excludes background) (μ g.m^{-3})	16.91	9.25	12.96	8.84	13.91
Ratio of Monitored Road Contribution NOx / Modelled Road Contribution Nox	2.1	2.6	2.8	1.4	2.1

Model Verification	NO_2 Monitoring Location				
	17	*30*	*33*	*34*	*77*
Adjustment Factor for Modelled Road Contribution	2.24785				
Adjusted Modelled Road Contribution NOx (μ g.m^{-3})	38.00	20.78	29.13	19.88	31.28
Modelled Total NO_2 (based on empirical NOx / NO_2 relationship) (μ g.m^{-3})	29.91	21.48	25.64	20.9	25.67
Monitored Total NO_2 (μ g.m^{-3})	29	23	29	17	25
% Difference [(modelled - monitored) / monitored] x 100	3.14	-6.61	-11.59	22.94	2.68

9.10.8.17 There is no PM_{10} and $PM_{2.5}$ monitoring carried out within the air quality study area in ERYC to enable verification of the model outputs for these pollutants. Therefore, the derived NOx adjustment factor was applied to modelled PM_{10} and $PM_{2.5}$ concentrations to provide a conservative assessment.

9.10.9 NOx to NO_2 Conversion

9.10.9.1 NOx concentrations were predicted using the ADMS-Roads model. The modelled road contribution of NOx at the identified receptor locations was then converted to NO_2 using the NOx to NO_2 calculator (v8.1) (Defra 2020c), in accordance with Defra guidance (Defra 2018).

9.10.10 Background Pollutant Concentrations

9.10.10.1 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 from Defra mapping (Defra 2020a) for the 1 km x 1 km grid squares covering the air quality study area and receptor locations for 2019 and 2024.

9.10.10.2 Background ammonia concentrations along with nutrient nitrogen and acid deposition were obtained from the APIS website (CEH 2021) and are provided for 5 km x 5 km grid squares. The data are provided as three-year averages (2017 – 2019) and are not factored forward to future years. Concentrations of NO_x at designated ecological sites were obtained from the Defra background maps as these are available at finer resolution (1 km x 1 km) and are projected to future years.

9.10.11 Calculation of Short-Term Pollutant Concentrations

9.10.11.1 Defra guidance (Defra 2018) 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 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)

9.10.11.2 Research projects completed on behalf of Defra and the Devolved Administrations (Laxen and Marner 2003 and 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 µg.m^3. This value was therefore used as an annual mean equivalent threshold to evaluate likely exceedance of the hourly mean NO_2 Objective.

9.10.12 Identification of Receptors

Construction and Decommissioning Phase Dust Generation

9.10.12.1 The human receptors within 350 m and ecological receptors within 200 m of the landfall, ECC and OnSS are shown in **Figure 9.1** and **Figure 9.5**.

9.10.12.2 At landfall, there are very few isolated farmsteads located within 350 m of the boundary. As landfall is on the east coast, the prevailing westerly/ south-westerly wind will blow dust emissions seaward and away from any landside receptors.

9.10.12.3 The route of the onshore ECC has been designed to avoid sensitive receptors (Co133), in order to minimise impacts. As such, there are few scattered receptors within 350 m of the onshore ECC.

9.10.12.4 Ecological receptors within 200 m of the ECC have also been identified, which include the River Hull Headwaters SSSI and Birkhill Wood Ancient Woodland.

9.10.12.5 The OnSS will require the most intensive construction works, and there are multiple receptors within 350 m of this area. The mitigation measures, detailed in the CoCP (Co124) (**Volume F2, Chapter 2: Outline Code of Construction Practice**), will prevent significant impacts from occurring at these receptors.

Construction Phase Road Traffic Emissions

Human Receptors

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

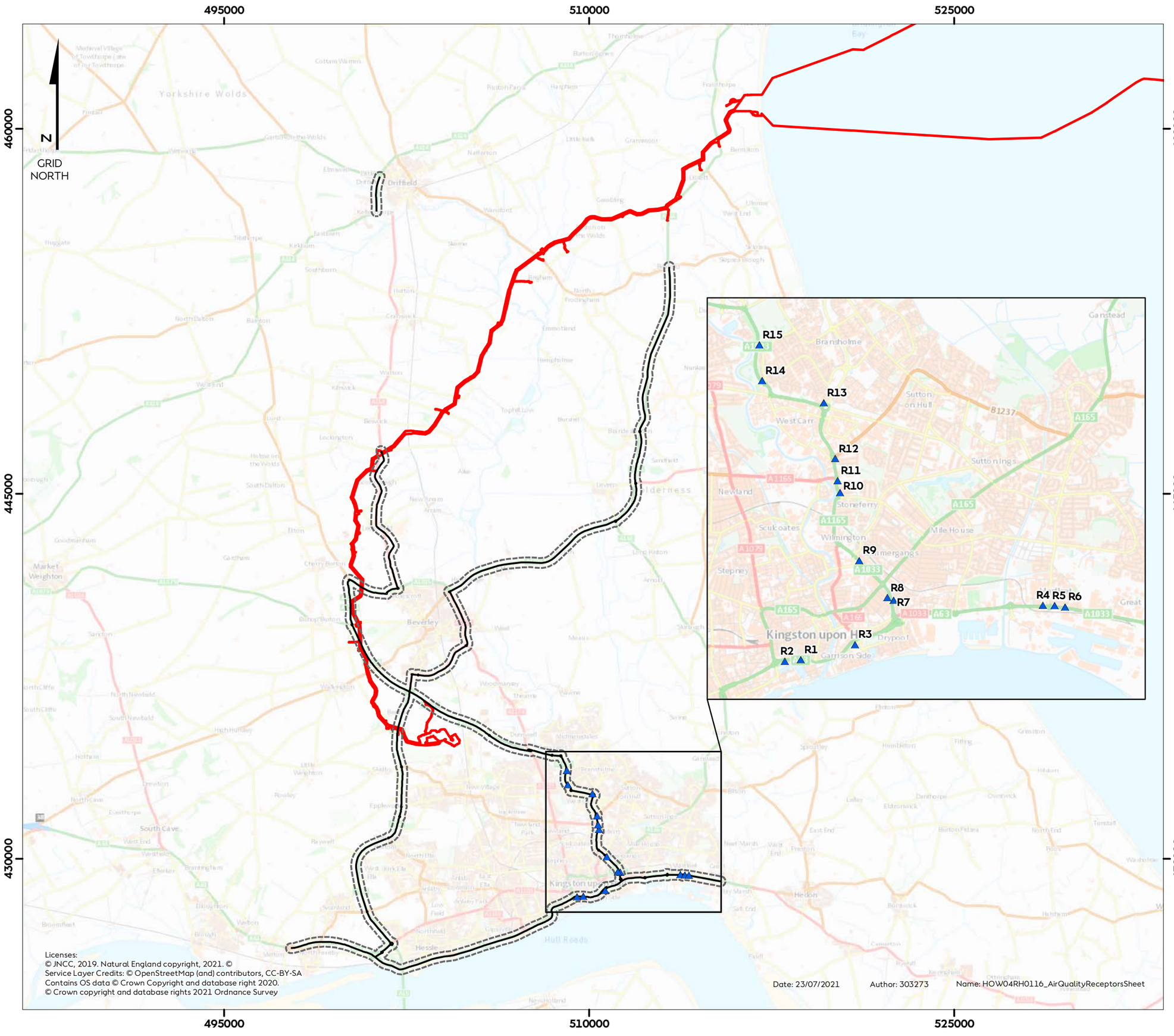
9.10.12.7 A sample of sensitive receptor locations within 200 m of assessed roads was selected, based on the proximity to road links affected by Hornsea Four, where the potential effect of development-generated traffic emissions on local air pollution would be most significant,

including within the Hull AQMA. This includes residential dwellings, schools and hospitals. Other receptors within 200 m of the assessed road network may also experience changes in pollutant concentrations, but to a lesser degree than those considered. The sensitive human receptor locations are detailed in **Table 9.22** and in **Figure 9.8**.

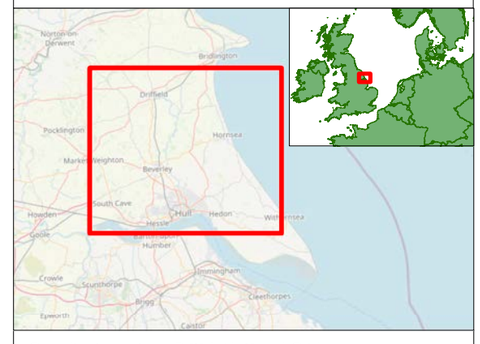
Hornsea Four

Figure 9.8

Air Quality Human Receptors



- Order Limits
- 200 m Study Area
- Air Quality Study Area - Roads
- Human Receptors



Coordinate system: British National Grid

Scale@A3: 1:150,000

0 2 4 8 Kilometres

0 1 2 4 Miles

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Human Receptors
Document no: HOW04RH0116
Created by: AZ
Checked by: CC
Approved by: CS

Royal HaskoningDHV

Ørsted

Table 9.22: Sensitive Human Receptor Locations.

Receptor ID	Location	Ordnance Survey (OS) grid reference	
		X	*Y*
R1	Hull AQMA	509766	428459
R2	Hull AQMA	509502	428434
R3	The Haven	510656	428709
R4	Hedon Road	513742	429353
R5	Hedon Road	513939	429345
R6	Hedon Road	514108	429328
R7	Ripon Way	511290	429440
R8	Abbey Street	511187	429477
R9	Dansom Lane North	510726	430089
R10	Mayville Avenue	510410	431208
R11	Stoneferry Primary School	510367	431400
R12	Stoneferry Road	510330	431765
R13	Tynedale	510139	432685
R14	Riverview Gardens	509130	433044
R15	The Croft	509083	433637

Ecological Receptors

9.10.12.8 The Bryan Mills Field SSSI, River Hull Headwaters SSSI and Humber Estuary SAC, SPA and Ramsar site are located within 200 m of roads which are anticipated to experience increases in traffic flows as a result of Hornsea Four or in-combination with other plans and projects, which exceed the criteria in **Table 9.12**.

9.10.12.9 The habitats present within 200 m of the road edge were determined using the MAGIC mapping system (Defra 2021). The APIS website (CEH 2021) was consulted to identify whether these habitats or features were sensitive to nutrient nitrogen or acid deposition and the relevant Critical Loads were obtained. The designated ecological sites considered in the assessment and associated Critical Load values are detailed in **Table 9.23** and shown in **Figure 9.9**.

Table 9.23: Designated Ecological Sites and Critical Load Values.

Designated ecological site	Habitat or feature within 200 m of road edge	Nutrient Nitrogen ($kgN.ha^{-1}.y^{-1}$)	Acidity Minimum Critical Load			Acidity Maximum Critical Load		
		Critical Load Range	*CLminN*	*CLmaxS*	*CLmaxN*	*CLminN*	*CLmaxS*	*CLmaxN*
Bryan Mills Field SSSI	Rich fens	15 - 30	0.438	1.58	2.018	0.438	1.58	2.018
River Hull Headwaters SSSI	Broadleaved woodland	10 - 20	0.142	0.809	1.166	0.357	10.849	11.159
	Rich fens	15 - 30	0.223	0.17	0.608	0.438	4.09	4.518
Humber Estuary SAC, SPA, SSSI, Ramsar	Saltmarsh	20 - 30	Saltmarsh habitat not sensitive to the effects of acid deposition					

480000
495000
510000
460000
445000
430000

N
GRID NORTH

River Hull Headwaters SSSI
T3b-1
T3b-3
T3b-4
T3b-5
T3a-3
T3a-2
T3a-1
T3b-2
0 100 200 Metres

Bryan Mills Field SSSI
T1-3
T1-2
T1-1
0 100 200 Metres

Humber Estuary Ramsar, SPA & SAC
T2-1
T2-2
T2-3
0 100 200 Metres

River Hull Headwaters SSSI
Bryan Mills Field SSSI
Humber Estuary Ramsar, SSSI, SPA & SAC

Date: 23/07/2021 Author: 303273 Name: HOW04RH0091_AirQualityEcologicalReceptors

Hornsea Four

Figure 9.9

Air Quality Ecological Receptors

- Order Limits
- 200 m Study Area
- Air Quality Study Area - Roads
- Ecological Receptors

Statutory Designations

- Sites of Special Scientific Interest (SSSI)
- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Ramsar

Coordinate system: British National Grid
Scale@A3: 1:150,000
0 2 4 8 Kilometres
0 1 2 4 Miles

REV	REMARK	DATE
	First Issue for PEIR	02/07/2019
A	Updated following PEIR consultations, for DCO	23/07/2021

Title: Air Quality Ecological Receptors
Document no: HOW04RH0091
Created by: AZ
Checked by: CC
Approved by: CS

Royal HaskoningDHV
Ørsted

9.10.12.10 Receptors were included in the model as transects through the designated sites, at 50 m intervals back from the road. Beyond 200 m of the road edge, impacts are considered to be insignificant as sufficient dilution and dispersion of pollutants will occur across this distance to minimise effects.

9.10.12.11 The Humber Estuary SAC, SPA and SSSI only contains terrestrial habitat within 100m of the road edge; as such, impacts were considered across this distance to represent the extent of the designation which would be affected by air pollution. At 100 m – 200 m from the road edge, the land is submerged by water. The APIS website states that marine habitats (some intertidal habitats are deemed sensitive to air pollution) don't tend to be sensitive to air pollution impacts or are dominated by other sources of inputs to the system (CEH 2021).

9.10.12.12 The Bryan Mills Field SSSI and River Hull Headwaters SSSIs are relatively small in size, and the full width of the sites from the road edge is less than 200 m. Therefore, transects were included in the dispersion model across the width of the designations.

9.10.12.13 The transects are shown in **Figure 9.9** and the locations are detailed in **Table 9.24**.

Table 9.24: Ecological Receptor Transects.

Designated Ecological Site	Transect ID	Distance from Road (m)	OS Grid Reference	
			X	*Y*
Bryan Mills Field SSSI	T1-1	0	501390	446128
	T1-2	50	501344	446151
	T1-3	100	501300	446174
Humber Estuary SAC, SPA, SSSI, Ramsar	T2-1	0	504842	426136
	T2-2	50	504858	426090
	T2-3	100	504874	426044
River Hull Headwaters SSSI – west of A614	T3a-1	0	501237	457358
	T3a-2	50	501187	457358
	T3a-3	100	501154	457358
River Hull Headwaters SSSI – east of A614	T3b-1	0	501256	457357
	T3b-2	50	501306	457357
	T3b-3	100	501356	457357
	T3b-4	150	501406	457357
	T3b-5	185	501447	457357

9.11 Impact assessment

9.11.1 Construction

9.11.1.1 The impacts of the onshore construction of Hornsea Four have been assessed on air quality. The environmental impacts arising from the construction of Hornsea Four are listed in **Table**

9.11 along with the maximum design scenario against which each construction phase impact has been assessed.

9.11.1.2 A description of the potential effect on air quality receptors caused by each identified impact is given below.

Road traffic exhaust emissions (AQ-A-2b)

Human Receptors

9.11.1.3 Predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for the 2024 year of peak construction are detailed in Table 9.25 to Table 9.28. Concentrations for 'without project' scenarios and the predicted change in NO_2, PM_{10} and $PM_{2.5}$ concentrations, as a result of Hornsea Four, are also shown for comparison purposes.

Table 9.25: Annual Mean NO_2 results at Sensitive Human Receptor Locations.

Receptor ID	Annual mean NO_2 concentrations ($\mu g.m^{-3}$)				
	Without Hornsea Four	*With Hornsea Four*	*Change*	*Change as percentage of objective (%)*	*Impact descriptor*
R1	33.0	33.3	0.3	1%	Negligible
R2	27.6	27.8	0.2	0%	Negligible
R3	21.2	21.3	0.1	0%	Negligible
R4	25.1	25.3	0.2	0%	Negligible
R5	29.4	29.7	0.3	1%	Negligible
R6	30.2	30.4	0.1	0%	Negligible
R7	19.2	19.3	0.1	0%	Negligible
R8	18.3	18.4	0.1	0%	Negligible
R9	25.3	25.7	0.4	1%	Negligible
R10	20.9	21.2	0.3	1%	Negligible
R11	23.2	23.6	0.4	1%	Negligible
R12	28.8	29.5	0.7	2%	Negligible
R13	23.3	23.6	0.3	1%	Negligible
R14	17.5	17.9	0.4	1%	Negligible
R15	14.4	14.5	0.1	0%	Negligible

Table 9.26: Annual Mean PM_{10} results at Sensitive Human Receptor Locations.

Receptor ID	Annual mean PM_{10} concentrations ($\mu g.m^{-3}$)				
	Without Hornsea Four	*With Hornsea Four*	*Change*	*Change as percentage of objective (%)*	*Impact descriptor*
R1	18.63	18.72	0.08	0%	Negligible
R2	17.13	17.18	0.05	0%	Negligible
R3	15.25	15.27	0.02	0%	Negligible
R4	16.39	16.43	0.04	0%	Negligible
R5	16.77	16.82	0.05	0%	Negligible
R6	15.84	15.88	0.04	0%	Negligible
R7	16.25	16.27	0.03	0%	Negligible
R8	16.05	16.06	0.02	0%	Negligible
R9	16.33	16.41	0.09	0%	Negligible
R10	15.49	15.53	0.04	0%	Negligible
R11	15.76	15.81	0.05	0%	Negligible
R12	16.47	16.56	0.09	0%	Negligible
R13	15.75	15.79	0.04	0%	Negligible
R14	15.51	15.57	0.06	0%	Negligible
R15	15.13	15.16	0.03	0%	Negligible

Table 9.27: Short-term Exceedances of PM_{10} at Sensitive Human Receptor Locations.

Receptor ID	Number of Exceedances of the short-term PM_{10} Objective (Days)		
	Without Hornsea Four	*With Hornsea Four*	*Change*
R1	2	2	0
R2	1	1	0
R3	0	0	0
R4	0	0	0
R5	1	1	0
R6	0	0	0
R7	0	0	0
R8	0	0	0
R9	0	0	0
R10	0	0	0
R11	0	0	0
R12	0	1	0
R13	0	0	0
R14	0	0	0
R15	0	0	0

Table 9.28: Annual Mean $PM_{2.5}$ results at Sensitive Human Receptor Locations.

Receptor ID	Annual mean $PM_{2.5}$ concentrations ($\mu g.m^{-3}$)				
	Without Hornsea Four	*With Hornsea Four*	*Change*	*Change as percentage of objective (%)*	*Impact descriptor*
R1	11.38	11.42	0.03	0%	Negligible
R2	10.56	10.58	0.02	0%	Negligible
R3	9.57	9.58	0.01	0%	Negligible
R4	9.98	10.00	0.02	0%	Negligible
R5	10.20	10.23	0.03	0%	Negligible
R6	9.83	9.85	0.02	0%	Negligible
R7	10.43	10.45	0.01	0%	Negligible
R8	10.32	10.33	0.01	0%	Negligible
R9	10.66	10.70	0.04	0%	Negligible
R10	9.90	9.93	0.02	0%	Negligible
R11	10.06	10.09	0.03	0%	Negligible
R12	10.47	10.51	0.05	0%	Negligible
R13	10.11	10.13	0.02	0%	Negligible
R14	9.43	9.46	0.03	0%	Negligible
R15	9.21	9.23	0.02	0%	Negligible

9.11.1.4 The results show that annual mean pollutant concentrations were predicted to be below the relevant air quality Objectives for all pollutants considered at all receptors, including within the Hull AQMA.

9.11.1.5 Impacts resulting from Hornsea Four were predicted to be no greater than 2% of the annual mean Objectives for all pollutants, at all receptors considered. Impacts were predicted to be 'negligible' for all pollutants.

9.11.1.6 All predicted NO_2 concentrations were well below 60 $\mu g.m^{-3}$ and, therefore, in accordance with Defra guidance (Defra 2018), the 1-hour mean Objective is unlikely to be exceeded.

9.11.1.7 Based on the calculation provided by Defra (Defra 2018), the short-term PM_{10} Objective was predicted to be met at all modelled locations with fewer than 35 exceedances of the daily mean objective of 50 $\mu g.m^{-3}$.

Significance of the effect

9.11.1.8 IAQM and EPUK Guidance states that professional judgement should be used to determine the overall significance of impact taking into account the impact at individual receptors. This assessment concludes that development-generated 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 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 derivation of the traffic data was taken, as described in **Chapter 7: Traffic and Transport**.

9.11.1.9 HCC's SPD requires a further assessment of significance to be made with respect to the objectives of the SPD, namely, to ensure the air quality Objectives are met and to improve air quality in Hull. Hornsea Four was predicted to lead to a negligible increase in pollutant concentrations at all receptors assessed, including within the AQMA, and was shown not to lead to exceedances of the air quality Objectives. As such, no new AQMAs are considered to be required.

9.11.1.10 The Environmental Quality SPD states HCC's aspirations to minimise emissions from all developments, even where negligible increases in air pollutants are expected, to avoid significant 'baseline creep'. The traffic flows considered in the assessment have been generated based on a number of worst-case assumptions (as described in **Chapter 7: Traffic and Transport**) and are therefore considered to be conservative. Notwithstanding, Hornsea Four is committed to minimising the impacts of the project and, as such, undertook further work between the PEIR and ES stages to minimise maximum traffic flows insofar as possible through refinements to project design, as detailed in **Section 9.10**. This resulted in a reduction of 95 HGVs per day on the road links within Hull.

9.11.1.11 It is noted that the suggestions for mitigation included within the Environmental Quality SPD relate primarily to residential and commercial developments (e.g. offices, retail and other businesses) and include the use of car-free developments and reduced parking provision, avoiding the creation of street canyons and the integration of sustainable transport modes into development design. These measures are not directly applicable to a project of this nature, and the potential for further reductions in generated emissions is therefore limited. Hornsea Four's commitments include the production of a CoCP, based on the outline CoCP (Co124, and **Volume F2, Chapter 2: Outline Code of Construction Practice**), to which an outline CTMP is appended. These documents contain Hornsea Four's proposed approach to minimising emissions insofar as possible, including use of Euro VI-standard construction vehicles (where practicable and where specific specialised operations will allow), and to undertake a review of potential peak hour working and its effect on

localised junction congestion, to enable these effects to be appropriately managed and mitigated.

9.11.1.12 Given the above, it is not considered that air quality impacts are significant.

Ecological Receptors

Critical Loads

9.11.1.13 The impact of project-generated traffic flows in 2024 (and the resultant impact on air quality) and in-combination impacts on ecological receptors within the air quality study area, in relation to the nutrient nitrogen and acidity Critical Loads, is detailed in **Table 9.29** to **Table 9.34**. The contribution of ammonia from road vehicles to nutrient nitrogen and acid deposition is included within the reported values.

Table 9.29: Nutrient Nitrogen Deposition Results.

Designated ecological site	Transect ID	Habitat	Nutrient nitrogen deposition (kgN.ha.y^{-1})			
			Contribution from background traffic growth	*Contribution from Agriculture*	*Contribution from Industry*	*Contribution from Hornsea Four*
Bryan Mills Field SSSI	T1-1	Rich fens	0.31	0.15	-	0.29
	T1-2		0.06	0.15	-	0.064
	T1-3		0.04	0.15	-	0.038
Humber Estuary SAC SPA SSSI Ramsar	T2-1	Saltmarsh	0.95	0.03	-	0.175
	T2-2		0.28	0.03	-	0.054
	T2-3		0.16	0.03	-	0.033
River Hull Headwaters SSSI	T3a-1	Broadleaved woodland	0.77	1.17	0.01	0.094
	T3a-2		0.16	1.17	0.01	0.021
	T3a-3		0.10	1.18	0.01	0.016
	T3b-1		0.96	1.17	0.01	0.11
	T3b-2		0.23	1.17	0.01	0.032
	T3b-3		0.13	1.17	0.01	0.022
	T3b-4		0.10	1.17	0.01	0.015
	T3b-5		0.08	1.17	0.01	0.010

Table 9.30: Nutrient Nitrogen Deposition as Percentage of Critical Load.

Designated ecological site	Transect ID	Impact of Hornsea Four as Percentage of Critical Load Nutrient Nitrogen			Impact of Hornsea Four In-Combination Nutrient Nitrogen		
		% of lowest Critical Load	*% of mid-range Critical Load*	*% of highest Critical Load*	*% of lowest Critical Load*	*% of mid-range Critical Load*	*% of highest Critical Load*
Bryan Mills Field SSSI	T1-1	1.9%	1.3%	1.0%	5.0%	3.3%	2.5%
	T1-2	0.4%	0.3%	0.2%	1.9%	1.2%	0.9%
	T1-3	0.3%	0.2%	0.1%	1.5%	1.0%	0.8%
Humber Estuary SAC SPA SSSI Ramsar	T2-1	0.9%	0.7%	0.6%	5.8%	4.6%	3.9%
	T2-2	0.3%	0.2%	0.2%	1.8%	1.4%	1.2%
	T2-3	0.2%	0.1%	0.1%	1.1%	0.9%	0.8%
River Hull Headwaters SSSI	T3a-1	0.9%	0.6%	0.5%	20.5%	13.7%	10.2%
	T3a-2	0.2%	0.1%	0.1%	13.6%	9.1%	6.8%
	T3a-3	0.2%	0.1%	0.1%	13.1%	8.7%	6.6%
	T3b-1	1.1%	0.8%	0.6%	22.6%	15.1%	11.3%
	T3b-2	0.3%	0.2%	0.2%	14.5%	9.6%	7.2%
	T3b-3	0.2%	0.1%	0.1%	13.4%	8.9%	6.7%
	T3b-4	0.1%	0.1%	0.1%	12.9%	8.6%	6.5%
	T3b-5	0.1%	0.1%	0.1%	12.7%	8.5%	6.4%

9.11.1.14 As shown in **Table 9.30**, Hornsea Four alone was predicted to result in impacts above 1% of the lowest Critical Load at the closest locations on the transect at the Bryan Mills Field SSSI and the River Hull Headwaters SSSI (east of the A614). At 50 m back from the road edge, the contribution of Hornsea Four dropped well below 1%.

9.11.1.15 In-combination nutrient nitrogen deposition, including contributions from background traffic growth, agriculture and industry, was predicted to exceed 1% of the relevant lowest Critical Load at all sites. As predicted impacts of the project alone and in-combination deposition cannot be considered to be insignificant, additional context as to background deposition rates is required. **Table 9.31** details background nutrient nitrogen deposition at each site and the total deposition (including the in-combination contribution) as a percentage of the range of Critical Load values.

Table 9.31: Background Nutrient Nitrogen Deposition and Total Deposition in Relation to the Critical Load Ranges.

Designated ecological site	Transect ID	Background Deposition Nutrient Nitrogen (kgN.ha.y^{-1})	Total Nutrient Nitrogen Deposition		
			% of lowest Critical Load	*% of mid-range Critical Load*	*% of highest Critical Load*
Bryan Mills Field SSSI	T1-1	24.43	199%	133%	100%
	T1-2	24.43	172%	115%	86%
	T1-3	24.43	169%	112%	84%
Humber Estuary SAC SPA SSSI Ramsar	T2-1	20.40	171%	137%	114%
	T2-2	20.40	123%	98%	82%
	T2-3	20.40	115%	92%	76%
River Hull Headwaters SSSI	T3a-1	67.48	812%	541%	406%
	T3a-2	67.48	713%	475%	357%
	T3a-3	67.48	704%	470%	352%
	T3b-1	67.48	839%	560%	420%
	T3b-2	67.48	725%	484%	363%
	T3b-3	67.48	709%	473%	355%
	T3b-4	67.48	703%	469%	352%
	T3b-5	67.48	700%	467%	350%

9.11.1.16 As shown in Table 9.31, background deposition is above some Critical Load values at all sites both without and with the effect of the in-combination contributions. Additional ecological interpretation is therefore required, as discussed below.

Table 9.32: Acid Deposition Results.

Designated ecological site	Transect ID	Habitat	Acid deposition (keq.ha.y^{-1})			
			Contribution from background traffic growth	*Contribution from Agriculture*	*Contribution from Industry*	*Contribution from Hornsea Four*
Bryan Mills Field SSSI	T1-1	Rich fens	0.022	0.01	-	0.021
	T1-2		0.004	0.01	-	0.005
	T1-3		0.003	0.01	-	0.003
River Hull Headwaters SSSI	T3a-1	Broadleaved woodland	0.055	0.08	0.0004	0.007
	T3a-2		0.011	0.08	0.0004	0.002
	T3a-3		0.007	0.08	0.0004	0.001
	T3b-1		0.069	0.08	0.0004	0.008
	T3b-2		0.017	0.08	0.0004	0.002

Designated ecological site	Transect ID	Habitat	Acid deposition (keq.ha.y^{-1})			
			Contribution from background traffic growth	*Contribution from Agriculture*	*Contribution from Industry*	*Contribution from Hornsea Four*
	T3b-3		0.010	0.08	0.0004	0.002
	T3b-4		0.007	0.08	0.0004	0.001
	T3b-5		0.006	0.08	0.0004	0.001

Table 9.33: Acid Deposition as Percentage of Critical Load

Designated ecological site	Transect ID	Impact of Hornsea Four as Percentage of Critical Load Acid			Impact of Hornsea Four In-Combination Acid		
		% of lowest Critical Load	*% of mid-range Critical Load*	*% of highest Critical Load*	*% of lowest Critical Load*	*% of mid-range Critical Load*	*% of highest Critical Load*
Bryan Mills Field SSSI	T1-1	1.0%	1.0%	1.0%	2.5%	2.5%	2.5%
	T1-2	0.2%	0.2%	0.2%	0.8%	0.8%	0.8%
	T1-3	0.1%	0.1%	0.1%	0.6%	0.6%	0.6%
River Hull Headwaters SSSI	T3a-1	0.6%	0.1%	0.1%	12.3%	2.3%	1.3%
	T3a-2	0.1%	0.0%	0.0%	8.1%	1.5%	0.8%
	T3a-3	0.1%	0.0%	0.0%	7.8%	1.5%	0.8%
	T3b-1	0.7%	0.1%	0.1%	13.6%	2.6%	1.4%
	T3b-2	0.2%	0.0%	0.0%	8.6%	1.6%	0.9%
	T3b-3	0.1%	0.0%	0.0%	8.0%	1.5%	0.8%
	T3b-4	0.1%	0.0%	0.0%	7.7%	1.5%	0.8%
	T3b-5	0.1%	0.0%	0.0%	7.6%	1.4%	0.8%

9.11.1.17 As shown in **Table 9.33** the impact of Hornsea Four alone was predicted to be 1% of the Critical Loads for acid at the Bryan Mills Field SSSI, with impacts at all other sites below 1%. In-combination acid deposition was predicted to exceed 1% of the relevant Critical Load at both the Bryan Mills Field SSSI and the River Hull Headwaters SSSI. **Table 9.31** therefore details background acid deposition at each site and the total deposition (including the in-combination contribution) as a percentage of the range of Critical Load values.

Table 9.34: Background Acid Deposition and Total Deposition in Relation to the Critical Load Ranges

Designated ecological site	Transect ID	Background Deposition Acid - Nitrogen (keq.ha.y-1)	Background Deposition Acid - Sulphur (keq.ha.y-1)	Total Acid Deposition		
				% of lowest Critical Load	*% of mid-range Critical Load*	*% of highest Critical Load*
Bryan Mills Field SSSI	T1-1	1.70	0.2	113%	113%	113%
	T1-2	1.70	0.2	99%	99%	99%
	T1-3	1.70	0.2	97%	97%	97%
River Hull Headwaters SSSI	T3a-1	4.20	0.2	461%	87%	48%
	T3a-2	4.20	0.2	401%	76%	42%
	T3a-3	4.20	0.2	395%	75%	41%
	T3b-1	4.20	0.2	478%	90%	50%
	T3b-2	4.20	0.2	408%	77%	43%
	T3b-3	4.20	0.2	398%	75%	42%
	T3b-4	4.20	0.2	394%	75%	41%
	T3b-5	4.20	0.2	393%	74%	41%

9.11.1.18 As for nutrient nitrogen, **Table 9.34** shows that total acid deposition exceeds the most stringent Critical Load at the River Hull Headwaters SSSI. Ecological interpretation of these impacts is therefore required as described below.

Critical Levels

9.11.1.19 Critical Levels relate to airborne concentrations of pollutants which can affect vegetation. Impacts in relation to NOx and ammonia concentrations, as a result of road traffic, industrial and agricultural emissions, are detailed in **Table 9.35** to **Table 9.38**.

Table 9.35: Critical Level (NOx) Results.

Designated ecological site	Transect ID	NOx Concentration (µg.m^{-3})		
		Contribution from background traffic growth	*Contribution from Industry*	*Contribution from Hornsea Four*
Bryan Mills Field SSSI	T1-1	0.88	-	0.57
	T1-2	0.18	-	0.13
	T1-3	0.10	-	0.08
Humber Estuary SAC SPA SSSI Ramsar	T2-1	2.17	-	0.15
	T2-2	0.62	-	0.05
	T2-3	0.37	-	0.03
River Hull Headwaters SSSI	T3a-1	1.17	0.06	0.10

	T3a-2	0.24	0.06	0.02
	T3a-3	0.16	0.06	0.02
	T3b-1	1.45	0.06	0.12
	T3b-2	0.35	0.06	0.03
	T3b-3	0.20	0.06	0.02
	T3b-4	0.14	0.06	0.02
	T3b-5	0.12	0.06	0.01

Table 9.36: NOx Concentrations as a Percentage of the Critical Level

Designated ecological site	Transect ID	Project Contribution as % of Critical Level	In-Combination Contribution as % of Critical Level	Background NOx Concentration ($\mu g.m^{-3}$)	Total NOx Without Hornsea Four ($\mu g.m^{-3}$)	Total NOx With Hornsea Four ($\mu g.m^{-3}$)	Total NOx as % of Critical Level
Bryan Mills Field SSSI	T1-1	1.9%	1.0%	7.06	20.64	21.21	71%
	T1-2	0.4%	0.2%	7.06	10.08	10.20	34%
	T1-3	0.3%	0.1%	7.06	8.90	8.98	30%
Humber Estuary SAC SPA SSSI Ramsar	T2-1	0.00	6.7%	16.71	45.74	45.88	153%
	T2-2	0.00	1.9%	16.71	25.29	25.34	84%
	T2-3	0.00	1.1%	16.71	21.89	21.92	73%
River Hull Headwaters SSSI	T3a-1	0.3%	3.8%	7.65	25.39	25.48	85%
	T3a-2	0.1%	0.9%	7.65	11.44	11.46	38%
	T3a-3	0.1%	0.7%	7.65	10.20	10.22	34%
	T3b-1	0.4%	4.7%	7.65	29.31	29.42	98%
	T3b-2	0.1%	1.3%	7.65	13.16	13.19	44%
	T3b-3	0.1%	0.8%	7.65	10.94	10.96	37%
	T3b-4	0.1%	0.6%	7.65	10.03	10.04	33%
	T3b-5	0.0%	0.6%	7.65	9.61	9.63	32%

9.11.1.20 As shown in Table 9.36, the NOx contribution of the project was greater than 1% of the Critical Level at the closest point on the transect at the Bryan Mills Field SSSI, but below 1% at all other locations on the transect and at the other sites. In-combination contributions of NOx were above 1% of the Critical Level at all sites, mainly as a result of contributions from road traffic as there is a limited component from industrial processes.

9.11.1.21 Higher background NOx concentrations are experienced at the Humber Estuary SAC, SPA, SSSI and Ramsar than in the more rural settings of the River Hull Headwaters and Bryan Mills

Field SSSIs, leading to concentrations in exceedance of the Critical Level at the transect location closest to the road.

Table 9.37: Critical Level (Ammonia) Results.

Designated ecological site	Transect ID	Ammonia Concentration (µg.m^{-3})		
		Contribution from background traffic growth	*Contribution from Industry*	*Contribution from Hornsea Four*
Bryan Mills Field SSSI	T1-1	0.05	0.00	0.05
	T1-2	0.01	0.00	0.01
	T1-3	0.01	0.00	0.01
Humber Estuary SAC SPA SSSI Ramsar	T2-1	0.15	0.01	0.03
	T2-2	0.04	0.01	0.01
	T2-3	0.03	0.01	0.01
River Hull Headwaters SSSI	T3a-1	0.08	0.15	0.01
	T3a-2	0.02	0.15	0.00
	T3a-3	0.01	0.15	0.00
	T3b-1	0.09	0.15	0.01
	T3b-2	0.02	0.15	0.00
	T3b-3	0.01	0.15	0.00
	T3b-4	0.01	0.15	0.00
	T3b-5	0.01	0.15	0.00

Table 9.38: Ammonia Concentrations as a Percentage of the Critical Level

Designated ecological site	Transect ID	Project Contribution as % of Critical Level	In-Combination Contribution as % of Critical Level	Background Ammonia Concentration (µg.m^{-3})	Total Ammonia Without Hornsea Four (µg.m^{-3})	Total Ammonia With Hornsea Four (µg.m^{-3})	Total Ammonia as % of Critical Level
Bryan Mills Field SSSI	T1-1	1.6%	3.1%	2.86	3.56	3.60	120%
	T1-2	0.3%	0.7%	2.86	3.02	3.03	101%
	T1-3	0.2%	0.4%	2.86	2.96	2.97	99%
Humber Estuary SAC SPA SSSI Ramsar	T2-1	1.1%	6.3%	2.03	4.06	4.09	136%
	T2-2	0.3%	2.0%	2.03	2.64	2.65	88%
	T2-3	0.2%	1.3%	2.03	2.40	2.41	80%
River Hull Headwaters SSSI	T3a-1	1.0%	23.7%	5.22	6.51	6.52	652%
	T3a-2	0.2%	16.9%	5.22	5.61	5.61	561%
	T3a-3	0.2%	16.3%	5.22	5.53	5.53	553%

Designated ecological site	Transect ID	Project Contribution as % of Critical Level	In-Combination Contribution as % of Critical Level	Background Ammonia Concentration ($\mu g.m^{-3}$)	Total Ammonia Without Hornsea Four ($\mu g.m^{-3}$)	Total Ammonia With Hornsea Four ($\mu g.m^{-3}$)	Total Ammonia as % of Critical Level
	T3b-1	1.2%	25.7%	5.22	6.77	6.78	678%
	T3b-2	0.3%	17.7%	5.22	5.72	5.73	573%
	T3b-3	0.2%	16.6%	5.22	5.58	5.58	558%
	T3b-4	0.2%	16.2%	5.22	5.52	5.52	552%
	T3b-5	0.1%	15.9%	5.22	5.49	5.49	549%

9.11.1.22 As shown in **Table 9.38**, concentrations of ammonia from the project were at or above 1% of the Critical Level on the closest point of the transect to the road at all sites. Total ammonia concentrations were above the Critical Level at all sites; concentrations were highest at the River Hull Headwaters SSSI which has higher background ammonia concentrations than other sites, likely due to a greater number of agricultural sources in the area, and at this site the lower Critical Level of 1 $\mu g.m^{-3}$ applies as there are lichens and bryophytes present.

9.11.1.23 The significance of the above impacts must be evaluated by an ecologist to determine whether there would be any significant adverse impact on the features for which the sites are designated. The overall conclusion made by the ecologists is that there would be no adverse effects on integrity of the Humber Estuary SPA, SAC, SSSI and Ramsar site. Further discussion on the significance of the effects of nutrient nitrogen and acid deposition and NOx concentrations on the Humber Estuary SPA, SAC, SSSI and Ramsar is detailed in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** (with the assessment on the Humber Estuary SPA,SAC, SSSI and Ramsar contained within **Volume B2, Chapter 2: Report to Inform Appropriate Assessment**).

9.11.1.24 The significance of impacts upon the Bryan Mills Field SSSI and River Hull Headwaters SSSI was concluded to be of **slight adverse** significance. Further discussion of this conclusion is detailed in **Chapter 3 Ecology and Nature Conservation**.

Future monitoring

9.11.1.25 Impacts on air quality at human receptors were not predicted to lead to any significant impacts. As such, it is not anticipated that future monitoring for air quality would be required.

9.11.1.26 The requirement for any future monitoring at designated ecological sites is discussed in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** and **Chapter 3: Ecology and Nature Conservation**.

9.12 Cumulative effect assessment (CEA)

9.12.1.1 Cumulative effects can be defined as:

- effects upon a single receptor to arise as a result of impact interaction between different environmental topics from Hornsea Four; and
- incremental effects on that same receptor from other proposed and reasonably foreseeable projects and developments in combination with Hornsea Four. This includes all projects that result in a comparative effect that is not intrinsically considered as part of the existing environment and is not limited to offshore wind projects.

9.12.1.2 The overarching method followed in identifying and assessing potential cumulative effects in relation to the onshore environment is set out in **Volume A4, Annex 5.5: Onshore Cumulative Effects** and **Volume A4, Annex 5.6: Location of Onshore Cumulative Schemes**. The approach is based upon the PINS Advice Note 17: Cumulative Effects Assessment (PINS, 2019). The approach to the CEA is intended to be specific to Hornsea Four and takes account of the available knowledge of the environment and other activities around the Hornsea Four Order Limits.

9.12.1.3 The CEA has followed a four-stage approach developed from PINS Advice Note 17. These stages are set out in Table 2 of **Volume A4, Annex 5.5: Onshore Cumulative Effects**, with Table 4 detailing the onshore long list search areas extents or Zone of Impacts for each topic area. The proposed tier structure that is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in the Hornsea Four ES is set out in Table 3 of **Volume A4, Annex 5.5: Onshore Cumulative Effects**.

9.12.2 CEA Stage 2 Shortlist and Stage 3 Information Gathering

9.12.2.1 A short list of projects for CEA has been produced using the screening buffer/criteria set out in Table 2 of **Volume A4, Annex 5.5: Onshore Cumulative Effects**. Information regarding all other developments is provided in **Volume A4, Annex 5.5: Onshore Cumulative Effects** and **Annex 5.6: Location of Onshore Cumulative Schemes**.

9.12.2.2 Fourteen projects have been identified for inclusion on the shortlist of projects to be assessed cumulatively for air quality. The remaining projects have not been considered as resulting in likely cumulative significant effects (for this topic) as they are either outside the ZOI, have no temporal overlap or there is no potential effect pathway.

9.12.2.3 Furthermore, sub-regional growth in housing and employment, as adopted by the region's Local Plans, has been captured within future year traffic growth factors applied (further detail is provided in **Chapter 7 Traffic and Transport**) and used within the air quality assessment. The cumulative effect of housing and employment projects is therefore inherent in the air quality assessment, and these projects have not been carried through to the shortlist. Summary information on the shortlist projects progressing through this exercise

(i.e. the short-list of other projects) for assessment land use and agriculture is provided below in Table 9.40.

9.12.3 CEA Stage 3 Assessment

9.12.3.1 As stated in Table 2 of Volume A4, Annex 5.5: Onshore Cumulative Effects, the assessment is undertaken in two phases:

- Table 9.39 sets out the potential impacts assessed in this chapter and identifies the potential for cumulative effects to arise, providing a rationale for such determinations; and
- Table 9.40 sets out the CEA for each of the projects/developments that have been identified on the short-list of projects screened.

9.12.3.2 It should be noted that the second phase of this assessment is only undertaken if the first phase identifies that cumulative effects are possible. This summary assessment is set out in Table 9.39.

Table 9.39: Potential Cumulative Effects.

Impact		Potential for Cumulative Effect?	Rationale
Construction			
AQ-C-1	Construction phase dust generation	Yes	Potential for cumulative dust impacts to occur at receptors where there is a temporal overlap in the construction phases and sites are within 700 m of each other (i.e. where the 350 m Zone of Influence for construction dust would overlap)
AQ-A-2a and b	Construction phase road traffic emissions	Yes	Potential for cumulative road traffic generation on the same road links, leading to impacts at human and ecological receptors
AQ-A-2a and b	In-combination effects at designated ecological sites	Yes	In-combination increases in nutrient nitrogen and acid deposition and NOx and ammonia concentrations may cumulatively affect designated ecological sites
Operation			
There are unlikely to be any significant cumulative impacts from the operation of the project.			
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. Additionally, PINS have stated in their Scoping Opinion that cumulative decommissioning effects are scoped out of the EIA.			

9.12.3.3 The second phase of the CEA is a project specific assessment of the potential for any significant cumulative effects to arise due to the construction and/or operation and maintenance of Hornsea Four. To identify whether this may occur each shortlisted project is discussed in **Table 9.40**.

9.12.3.4 As described above, the air quality assessment was inherently cumulative as it included the effect of traffic growth from housing and employment uses. As such, where these projects were identified on the longlist, they have not been included within this chapter, as impacts were not found to be significant. Therefore, the projects detailed in **Table 9.40** include those not already accounted for explicitly within the provided traffic flow data.

9.12.3.5 The CEA has been based on information available on each potential project (e.g., as set out on ERYC planning portal or in an attendant, available ES) and it is noted that the project details available may change in the period up to construction or may not be available in detail at all. The assessment presented here is therefore considered to be conservative, with the level of impacts expected to be reduced compared to those presented here.

9.12.3.6 The CEA has not identified any potential impacts that are considered to be of any greater significance than those identified in isolation and no cumulative effects of significance are forecast.

Table 9.40: CEA Air Quality.

Project Name	Tier	Discussion	Likelihood and Significance of Cumulative Effects
Jocks Lodge Highway Improvement Scheme	1	ERYC submitted an application for improvements to the A164/Jocks Lodge (referred to hereafter as Jocks Lodge) junction in May 2020 with approval subsequently granted in July 2020. Construction is currently programmed to commence in 2022 and is scheduled for completion in 2026. There could therefore be a potential temporal overlap between the construction of Hornsea Four (scheduled to commence construction in 2024 at the earliest) and Jocks Lodge. However, the majority of construction is anticipated to be complete prior to the start of construction on Hornsea Four. The assessment presented in **Chapter 7: Traffic and Transport** concluded that there would be no significant effects between the two schemes. The oCTMP (as Appendix F of **Volume F2, Chapter 2: Outline Code of Construction**	No potential for significant cumulative effects.

Project Name	Tier	Discussion	Likelihood and Significance of Cumulative Effects
		Practice) submitted in support of the DCO application for Hornsea Four contains a commitment that if the finalised construction programmes for the CEA projects highlight a potential overlap, the Applicant would engage with ERYC to agree appropriate mitigation measures to be included in the final CTMP, thus limiting the potential for cumulative effects to occur.	
A63 Castle Street Roadworks	1	Highways England (now National Highways) submitted a DCO application for improvements to the A63 Castle Street in 2018 with approval subsequently granted in June 2020. Construction commenced in 2020 and is scheduled for completion by 2024/2025. There could therefore be a potential temporal overlap between the construction of Hornsea Four (scheduled to commence construction in 2024 at the earliest) and the A63 Castle Street scheme. The assessment presented in Chapter 7: Traffic and Transport concluded that there would be no significant effects between the two schemes. The oCTMP (as Appendix F of Volume F2, Chapter 2: Outline Code of Construction Practice) submitted in support of the DCO application for Hornsea Four contains a commitment that if the finalised construction programmes for the CEA projects highlight a potential overlap, the Applicant would engage with ERYC to agree appropriate mitigation measures to be included in the final CTMP, thus limiting the potential for cumulative effects to occur.	No potential for significant cumulative effects.
Humberdale, Egg Laying Unit	1	These projects generate nutrient nitrogen and acid deposition or NOx emissions which contribute to in-combination impacts at designated ecological sites. The contributions from these projects were considered in the impact assessment, as requested by Natural	No potential for significant cumulative effects.
Watton Abbey Farm	1		
Riverhead Hall Nursing Home	1		
The Beeches Building 1	1		

Project Name	Tier	Discussion	Likelihood and Significance of Cumulative Effects
The Beeches Building 12	1	England (see Table 9.6), which must inherently be cumulative to provide context in regard to the predicted impact of the project alone. The ecological assessments found that no adverse effects on site integrity would occur on the Humber Estuary SPA, SAC, SSSI and Ramsar site. Impacts on the River Hull Headwaters and Bryan Mills Field SSSI were found to be of slight adverse significance. Additional detail is provided in Volume A2, Chapter 2: Benthic and Intertidal Ecology, Chapter 3 Ecology and Nature Conservation and the Hornsea Four RIAA (Volume B2, Chapter 2: Report to Inform Appropriate Assessment).	
Kirkburn Grange	1		
Church Farm	1		
Clitheroe	1		
Thistledown Farm Livestock Building	1		
Driffield Road Egg Unit	1		
Albanwise Solar Farm	1	There is potential temporal and spatial overlap between this project and Hornsea Four, and therefore cumulative impacts of construction-generated dust and road traffic emissions could occur. The Albanwise solar farm would be constructed over a period of six months, and therefore any cumulative impacts would be of a short duration. The solar farm would utilise dust mitigation measures, implemented via a Construction Environmental Management Plan (CEMP), during construction to ensure that emissions of dust do not lead to significant impacts at receptors. As such, with the implementation of dust mitigation measures by both projects, it is unlikely that significant dust-related impacts would occur. The solar farm is expected to generate up to 20 daily HGV deliveries during the peak construction period. It is not expected that this level of additional traffic movements, occurring over a short-term period, would give rise to significant impacts at receptors given that no	No potential for significant cumulative effects.

Project Name	Tier	Discussion	Likelihood and Significance of Cumulative Effects
		significant effects was predicted as a result of Hornsea Four.	
Creyke Beck Substation Expansion	3	There is a potential temporal overlap between these projects with Hornsea Four, and therefore cumulative impacts of construction-generated dust and road traffic emissions could occur. It is expected that as part of any permission to carry out these cumulative projects, dust mitigation measures will be required to be implemented during construction to ensure that emissions of dust do not lead to significant impacts at receptors. As such, with the implementation of dust mitigation measures by all projects, it is unlikely that significant dust-related impacts would occur. There is not enough information currently known about these projects to enable the traffic demand and distribution to be determined. As such, a quantitative cumulative impact assessment could not be undertaken. It is expected that as part of future planning applications for the Creyke Beck substation expansion and SEGL2 project, a cumulative assessment with Hornsea Four would be undertaken to ensure that no significant air quality impacts would occur. Furthermore, due to the nature of the developments and the regulatory regimes under which they will be constructed, it is assumed (with high confidence) that appropriate mitigation air quality measures will be incorporated into the application documents (if required) thus limiting the potential for cumulative effects to occur.	No potential for significant cumulative effects.
Scotland England Green Link 2 (SEGL2)	3		

9.12.3.7 The CEA for air quality does not identify any reasonably foreseeable projects or developments where significant cumulative effects could arise. The significance of the cumulative effects on designated ecological sites is provided in **Volume A2, Chapter 2: Benthic and Intertidal Ecology**, **Chapter 3: Ecology and Nature Conservation** and the Hornsea Four RIAA (**Volume B2, Chapter 2: Report to Inform Appropriate Assessment**).

9.13 Transboundary effects

9.13.1.1 A screening of transboundary impacts is presented in Appendix K of the Scoping Report (Orsted 2018). This screening exercise identified that there was no potential for significant transboundary effects regarding air quality from Hornsea Four upon the interests of other EEA States and this is not discussed further.

9.14 Inter-related effects

9.14.1.1 Inter-related effects consider impacts from the construction, operation or decommissioning of Hornsea Four on the same receptor (or group). The potential inter-related effects that could arise in relation to air quality are presented in **Table 9.41**. Such inter-related effects include both:

- **Project lifetime effects**: i.e., those arising throughout more than one phase of the project (construction, operation, and decommissioning) to interact to potentially create a more significant effect on a receptor than if just one phase were assessed in isolation; and
- **Receptor led effects**: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor (or group). Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

9.14.1.2 A description of the process to identify and assess these effects is presented in **Section 2** of **Volume A1 Chapter 5: EIA Methodology**.

Table 9.41: Inter-related effects assessment for Air Quality.

Nature of inter-related effect		Assessment
Project-lifetime effects		
Construction, Operation and, decommissioning (AQ-C-1, AQ-A-2, AQ-O-3, AQ-O-4 and AQ-D-5)	Increases in pollutant concentrations at human receptors; and Increases in nutrient nitrogen and acid deposition and NOx and ammonia concentrations at ecological receptors	Impacts at human receptors were not predicted to be significant for the construction phase. The ecological assessments found that no adverse effects on site integrity would occur on the Humber Estuary SPA, SAC, SSSI and Ramsar site. Impacts on the River Hull Headwaters and Bryan Mills Field SSSI were found to be of slight adverse significance. Additional detail is provided in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** and **Chapter 3: Ecology and Nature Conservation**. Operational phase impacts were scoped out of the assessment. The decommissioning phase is not

Nature of inter-related effect		Assessment
		anticipated to give rise to impacts any greater in magnitude than those considered for construction. Impacts associated with air quality will only be experienced for the duration of each phase. The phases of the project cannot overlap temporally, therefore there is no potential for inter-related air quality impacts to occur.
Receptor-led effects		
Ecology and nature conservation: acid and nitrogen deposition on designated sites (ENC-C-1) (**Chapter 3: Ecology and Nature Conservation**).		The inter-related impact of construction phase road traffic emissions on designated ecological sites was considered in the air quality assessment. The significance of the effects is discussed in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** (with the assessment on the site itself contained within the Hornsea Four RIAA (**Volume B2, Chapter 2: Report to Inform Appropriate Assessment**)).
Human Health: Effects on human health resulting from fugitive dust and road traffic emissions in proximity to the landfall, onshore ECC OnSS, 400kV ECC, temporary access tracks and the highway network. (**Volume F2, Chapter 2: Outline Code of Construction Practice**).		Due to concurrent multiple activities, the construction phase presents the most likely opportunity for receptor-led effects. A range of effective onshore construction phase mitigation is proposed as part of Hornsea Four, which would be implemented through the CoCP (Co124). An outline CoCP has been provided as part of the ES (**Volume F2, Chapter 2: Outline Code of Construction Practice**). Given the effectiveness of the mitigation proposed, many effects during construction would be negligible to minor adverse and not significant. Notably no air quality objectives are predicted to be exceeded and health effects are not anticipated. Dust will be managed as part of the CoCP and is not predicted to be significant following implementation of measures set out in this document. Construction effects would be temporary. Effects in relation to construction views, noise, traffic and dust are not predicted to be significant. The proposed measures would control construction effects as far as reasonably practicable. The highest level of significance has been assigned to visual effects during construction at the OnSS, which may be up to moderate adverse. The assessment is presented in **Chapter 4: Landscape and Visual**. Overall, whilst inter-related effects on residents may arise from some locations on a temporary basis, they are unlikely to exceed the level reported for visual effects (moderate adverse). On the basis of the assessment undertaken, with mitigation measures, construction dust effects are considered to be not significant. Overall, no inter-related effects across the project phases are anticipated that exceed the significance level of assessment in isolation.
Land use and agriculture: Effects of dust on travellers, pedestrians/cyclists, users		Users of the local transport and rights of way networks may be affected by visual effects, together with effects arising as a result of noise, dust and traffic-related effects.

Nature of inter-related effect	Assessment
of public rights of way in proximity to the landfall, onshore ECC OnSS, 400kV ECC, temporary access tracks and the highway network (LUA-C-3) (**Chapter 6: Land Use and Agriculture**).	A moderate adverse visual effect has been identified in proximity to the OnSS, on a PRoW which would be directly impacted by the OnSS. No significant visual effects have been identified for other PRoW along the onshore ECC or at landfall. This receptor would therefore experience disruption to the route itself and a change in user experience, of which visual effects would form a part. Taking into account the commitment to divert the PRoW (Co 79) and the design measures presented in **Volume F2, Chapter 8: Outline Landscape Management Plan** and **Volume F2, Chapter 14: Outline Enhancement Strategy** and the temporary nature of the effect, it is not considered likely that any inter-related effect arising from dust, noise and visual effects would result in any greater level of effect than that reported in **Chapter 6: Land Use and Agriculture** (minor adverse and not significant).

9.14.1.3 The assessment concludes that there are no significant inter-related impacts from the construction, operation or decommissioning of Hornsea Four on air quality. Receptor-led inter-related ecological effects are discussed in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** and **Chapter 3: Ecology and Nature Conservation** (with the assessment on the site itself contained within the Hornsea Four RIAA (**Volume B2, Chapter 2: Report to Inform Appropriate Assessment**)).

9.15 Conclusion and summary

9.15.1.1 This chapter of the ES has assessed the potential impact from the onshore development of Hornsea Four on air quality receptors.

9.15.1.2 **Table 9.42** presents a summary of the significant impacts assessed within this ES, any mitigation and the residual effects. In accordance with the assessment methodology. Provided mitigation measures (both embedded and additional) are in place to prevent impacts on receptors from the project, potential impacts are anticipated to be **not significant** in relation to air quality.

9.15.1.3 No further mitigation is proposed in addition to the embedded project commitments (as set out in **Table 9.10**) which are deemed sufficient to offset any potential LSE from Hornsea Four.

9.15.1.4 No cumulative or inter-related effects have been identified which increase the significance of any standalone assessment set out in this chapter.

9.15.1.5 In summary, **no impacts** have been identified which are considered significant in EIA terms on air quality.

Table 9.42: Summary of potential impacts assessed for air quality (to be read in conjunction with **Volume A4, Annex 5.2: Commitments Register**).

Impact and Phase	Receptor and value/sensitivity	Magnitude and significance	Mitigation	Residual impact
Construction				
Construction-generated road traffic emissions (**AQ-A-2b**)	Human receptors Ecological receptors	Negligible impacts at all receptors Discussed further in **Volume A2, Chapter 2: Benthic and Intertidal Ecology** (with the assessment on the site itself contained within **Volume B2, Chapter 2: Report to Inform Appropriate Assessment**) and **Chapter 3: Ecology and Nature Conservation**	Co64, Co114, Co124, Co134 and Co135	Not significant
Operation				
Operational phase impacts were scoped out of the air quality assessment				
Decommissioning				
Decommissioning phase impacts were scoped out of the air quality assessment				

9.16 References

AEAT (2008) Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedances of the 1-hour mean AQS Objective, http://laqm.defra.gov.uk/documents/NO2relationship_report.pdf

Air Quality Consultants (2020a) Ammonia Emissions from Roads for Assessing Impacts on Nitrogen-sensitive Habitats https://www.aqconsultants.co.uk/CMSPages/GetFile.aspx?guid=3aa4ec2e-ee4e-4908-bc7a-aeb0231b4b37

Air Quality Consultants (2020b) Calculator for Road Emissions of Ammonia (CREAM) v1A https://www.aqconsultants.co.uk/CMSPages/GetFile.aspx?guid=b2d35cd9-1cf4-40f0-b0ef-163eef8a55b8

Centre for Ecology and Hydrology (2021) Air Pollution Information System Website, accessible via URL www.APIS.ac.uk.

Department of Energy and Climate Change (DECC) (2011a) Draft Overarching National Policy Statement for Energy (EN-1) London: The Stationery Office

Department of Energy and Climate Change (DECC) (2011b) National Policy Statement for Renewable Energy Infrastructure (EN-3) London: The Stationery Office

Department of Energy and Climate Change (DECC) (2011c) National Policy Statement for Electricity Networks Infrastructure (EN-1) London: The Stationery Office

Department for Environment, Food and Rural Affairs (Defra) (2007) 'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland', London: HMSO.

Department for the Environment Food and Rural Affairs (Defra) (2019) Clean Air Strategy 2019. London: HMSO [Online], Available at: https://www.gov.uk/government/consultations/air-quality-draft-clean-air-strategy-2018

Department for the Environment Food and Rural Affairs (Defra) (2018) Local Air Quality Management Technical Guidance Document Local Air Quality Management.TG (16) London: Defra

Department for the Environment Food and Rural Affairs (Defra) (2020a) Background Mapping Data. Available at: < http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018 >

Department for the Environment Food and Rural Affairs (Defra) (2020b) Emission Factor Toolkit v10.1. Available at: http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft

Department for the Environment Food and Rural Affairs (Defra) (2020c) NOx to NO2 Calculator v8.1. Available at: <http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html >

Department for the Environment Food and Rural Affairs (Defra) (2021) MAGIC interactive mapping website. Available at https://magic.defra.gov.uk/MagicMap.aspx

Department of the Environment (DoE) (1997) The UK National Air Quality Strategy London: HMSO

Department of the Environment, Transport & the Regions (DETR) (2000) Air Quality Strategy for England, Scotland, Wales and Northern Ireland. London: HMSO

Department of the Environment, Transport & the Regions (DETR) (2003) Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Addendum. London: HMSO

East Riding of Yorkshire Council (2020) Air Quality Annual Status Report

East Riding of Yorkshire Council (2016) East Riding Local Plan 2012 – 2029 Strategy Document

Environment Agency (2021) Air Emissions Risk Assessment for your Environmental Permit https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

European Parliament (1996) Council Directive 96/62/EC on Ambient Air Quality Assessment and Management

European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

Her Majesty's Stationary Office (HMSO) (1995) The Environment Act 1995 (c.25) London: TSO

Her Majesty's Stationary Office (HMSO) (2000) Statutory Instrument 2000 No. 928 The Air Quality (England) Regulations 2000 London: HMSO

Her Majesty's Stationary Office (HMSO) (2002) Statutory Instrument 2002 No. 3043 The Air Quality (England) (Amendment) Regulations 2002 London: HMSO

Her Majesty's Stationary Office (HMSO) (2010) Statutory Instrument 2010 No. 1001 The Air Quality (England) Regulations 2010 London: HMSO

Her Majesty's Stationary Office (HMSO) (2019) Statutory Instrument 2019 No. 74 The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 London: HMSO

Highways England (2019) Design Manual for Roads and Bridges LA 105 Air Quality

Hull City Council (2017) Hull Local Plan 2016 to 2032

Hull City Council (2017b) Kingston Upon Hull City Council 2017 Air Quality Strategy

Hull City Council (2020) Air Quality Annual Status Report

Hull City Council (2019) Hull Local Plan: 2016 to 2032 Environmental Quality Supplementary Planning Document 3

Hull City Council (undated) Air Quality Action Plan, accessed via https://uk-air.defra.gov.uk/assets/documents/no2ten/Local_zone18_KingstonUponHull_AQActionplan_1.pdf

Institute of Air Quality Management (IAQM) (2016) Guidance on the Assessment of Dust from Demolition and Construction

Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) (2017). Land-Use Planning & Development Control: Planning for Air Quality

Institute of Air Quality Management (2020) A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites

Laxen and Marner (2003) Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites

Natural England (2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, June 2018

Orsted (2018) Hornsea Project Four Scoping Report; available at: https://hornseaprojects.co.uk/Hornsea-Project-Four/Documents-Library

Orsted (2019) Hornsea Project Four Preliminary Environmental Information Report, Volume 3, Chapter 9 Air Quality https://orstedcdn.azureedge.net/-/media/www/docs/corp/uk/hornsea-project-four/01-formal-consultation/pier/volume-3/peir-volume-3-chapter-9-air-quality.ashx?la=en&rev=44f43ac0c07f4072aad3f04f102ae9c6&hash=2B75F7B6A1EE40A21CD64EEB31FE5C35

PINS (2012) Advice Note six: Preparation and submission of application documents. Bristol, PINS.

PINS (2019) Advice Note 17: Cumulative Effects Assessment. Bristol, PINS.