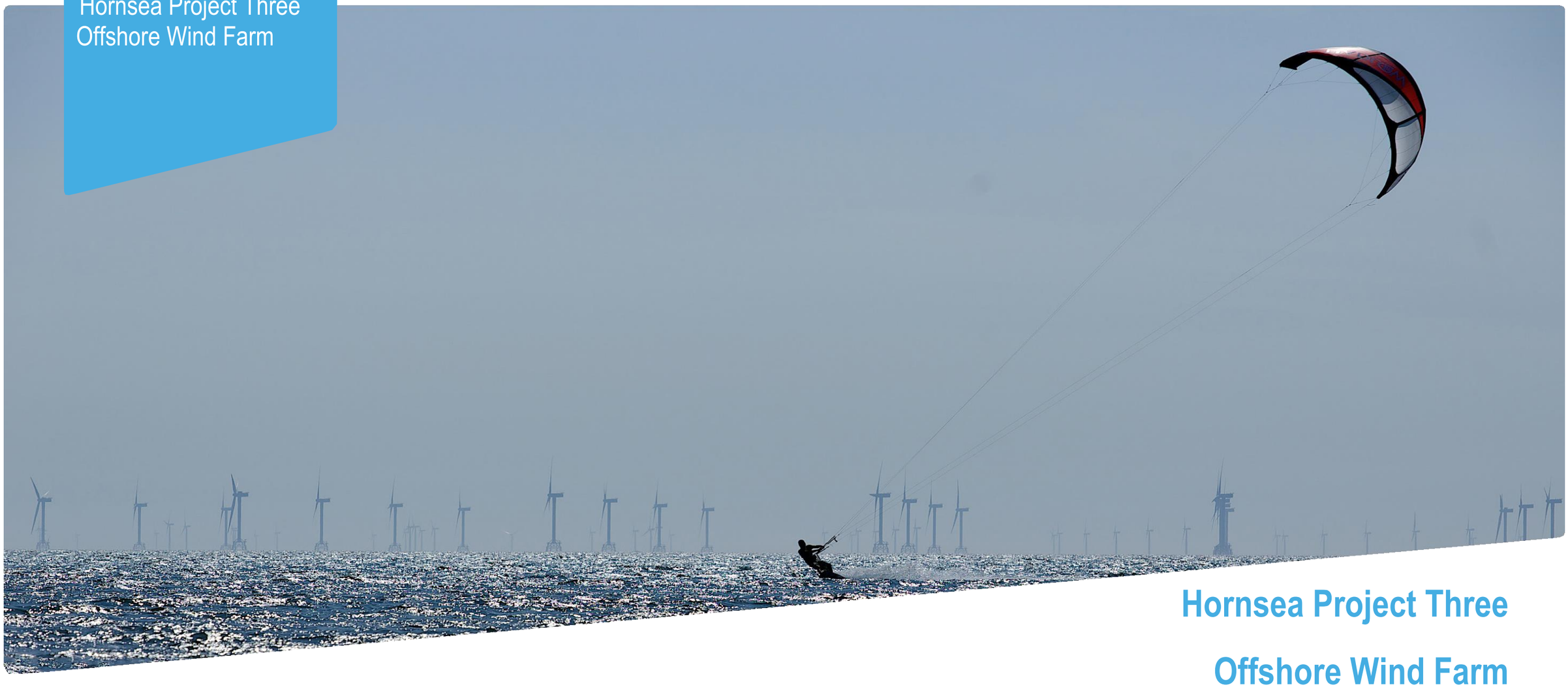
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Environmental Statement:
Volume 3, Chapter 9: Air Quality

PINS Document Reference: A6.3.9
APFP Regulation 5(2)(a)

Date: May 2018

Hornsea 3
Offshore Wind Farm

Ørsted

Environmental Impact Assessment

Environmental Statement

Volume 3

Chapter 9 – Air Quality

Liability

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Front cover picture: Kite surfer near a UK offshore wind farm © Orsted, Hornsea Project Three (UK) Ltd., 2018.

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Glossary

Term	Definition
Construction	Any activity involved with the provision of a new structure (or structures), its modification or re-furbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc.
Demolition	Any activity involved with the removal of an existing structure (or structures). This may also be referred to as de-construction, specifically when a building is removed a small part at a time.
Deposited Dust	Dust that has settled out onto a surface after having been suspended in air.
Dust	Solid particles suspended in air or settled out onto a surface after having been suspended in air
Earthworks	Covers the processes of soil-stripping, ground-levelling, excavation and landscaping.
Heavy Duty Vehicle	Vehicles greater than 3.5 t gross vehicle weight including buses
Heavy Goods Vehicle	Vehicles greater than 3.5 t gross vehicle weight, excluding buses
Impact	The change in atmospheric pollutant concentration and/or dust deposition. A scheme can have an 'impact' on atmospheric pollutant concentration but no effect, for instance if there are no receptors to experience the impact.
Light Duty Vehicle	Vehicles lighter than 3.5 gross vehicle weight.
Local Nature Reserve	A local authority designation under the National Parks and Access to the Countryside Act 1949 (as amended), and in consultation with relevant statutory nature conservation agencies.
Nuisance	A term often used in a general sense when describing amenity dust. This term also has specific meanings in environmental law: a. Statutory nuisance, as defined in S79 of the Environmental Protection Act 1990 b. Private nuisance, arising from substantial interference with a person's enjoyment and use of his land. c. Public nuisance, arising from an act of omission that obstructs, damages or inconveniences the rights of the company. Each of these applying in so far as the nuisance relates to the unacceptable effects of emissions. It is recognised that a significant loss of amenity may occur at lower levels of emission than would constitute a statutory nuisance.
Onshore elements of Hornsea Three	Hornsea Three landfall area, onshore cable corridor, the onshore HVAC booster station, the onshore HVDC converter/HVAC substation and the interconnection with the Norwich Main National Grid substation.
PM_{10}	Particulate matter of diameter less than or equal to 10 micrometres.
$PM_{2.5}$	Particulate matter of diameter less than or equal to 2.5 micrometres.
Risk	The likelihood of an adverse event occurring
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicle using the network

Acronyms

Acronyms	Description
AADT	Annual Average Daily Traffic Flow
ADMS	Atmospheric Dispersion Modelling System
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
DCO	Development Consent Order
DMMP	Dust Management and Monitoring Plan
EIA	Environmental Impact Assessment
EPUK	Environmental Protection UK
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAQM	Institute of Air Quality Management
LAQM.TG16	Local Air Quality Management Technical Guidance (TG16)
LGV	Light Goods Vehicle
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPS	National Policy Statement
NRMM	Non Road Mobile Machinery
SAC	Special Area of Conservation
SSSI	Site of Special Scientific Interest

Units

Unit	Description
GW	Gigawatt (power)
kV	Kilovolt (electrical potential)
kW	Kilowatt (power)

Unit	Description
$\mu g.m^{-3}$	Micrograms per cubic metre (concentration)
µm	Micrometre (distance)
km	Kilometre (distance)
m	Metre (distance)
m^2	Metres squared (area)
m^3	Metres cubed (volume)
t	Tonne (weight)

9. Air Quality

9.1 Introduction

9.1.1.1 This chapter of the Environmental Statement presents the results of the Environmental Impact Assessment (EIA) for the potential impacts of the Hornsea Project Three offshore wind farm (hereafter referred to as 'Hornsea Three') on air quality. Specifically, this chapter considers the potential impact of Hornsea Three landward of Mean High Water Springs (MHWS) during its construction, and decommissioning phases. The operation and maintenance of Hornsea Three are not expected to lead to air quality impacts with any likely significant effects and have therefore been scoped out of the assessment (see section 9.8.2).

9.1.1.2 Those impacts of Hornsea Three on ecologically, designated sites, and other habitats as a result of by airborne pollutants are assessed in chapter 3: Ecology and Nature Conservation, whilst the impacts on traffic and transport are assessed in chapter 7: Traffic and Transport. The air quality impacts resulting from additional transport generated by Hornsea Three will be are assessed within this chapter, whilst other impacts from traffic and transport are assessed in chapter 7: Traffic and Transport.

9.1.1.3 There are no technical reports accompanying this chapter.

9.2 Purpose of this chapter

9.2.1.1 The primary purpose of the Environmental Statement is to support the Development Consent Order (DCO) application for Hornsea Three under the Planning Act 2008 (the 2008 Act) and accompanies the application to the Secretary of State for Development Consent.

9.2.1.2 It is intended that the Environmental Statement will provide statutory and non-statutory consultees with sufficient information to complete the examination of Hornsea Three and will form the basis of agreement on the content of the DCO.

9.2.1.3 In particular, this Environmental Statement chapter:

- Presents the existing environmental baseline established from desk studies, together with relevant information from the consultation;
- Presents the potential environmental effects on air quality arising from Hornsea Three, based on the information gathered and the analysis and assessments undertaken;
- Identifies any significant assumptions and limitations encountered in compiling the environmental information;
- 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 Study area

9.3.1.1 This air quality assessment is based on two study areas.

9.3.1.2 The Hornsea Three air quality (construction dust) study area is shown in Figure 9.1 and comprises a 350 m buffer around the onshore elements of Hornsea Three (namely the Hornsea Three landfall area, the onshore cable corridor, the onshore HVAC booster station, the onshore HVDC converter/HVAC substation and the interconnection with the Norwich Main National Grid substation) as well as the compounds, storage areas and access corridors. This is in line with the Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014), which indicates that there could potentially be nuisance dust and PM_{10} effects on human health within 350 m from the dust sources on a site and within 50 m from site-traffic routes up to 500 m from a site entrance. No likely significant effects are expected to occur beyond these distances.

9.3.1.3 In accordance with the Local Air Quality Management (LAQM) Technical Guidance 2016, a traffic emissions assessment should model all roads on which there is a significant change in traffic (over 100 Heavy Goods Vehicles (HGVs) in an area without an Air Quality Management Area (AQMA) and 25 HGVs in an area with an AQMA). The Hornsea Three air quality (traffic emissions) study area therefore comprises a distance of 500 m from the site boundary along the roads to be used by construction traffic during the Hornsea Three construction and decommissioning phases. In addition, any roads where it has been predicted that there is an exceedance of 100 daily HGV movements as a result of Hornsea Three are included in the Hornsea Three air quality (traffic emissions) study area. Figure 9.2 shows location of the modelled access routes along with the location of the receptors which have been assessed.

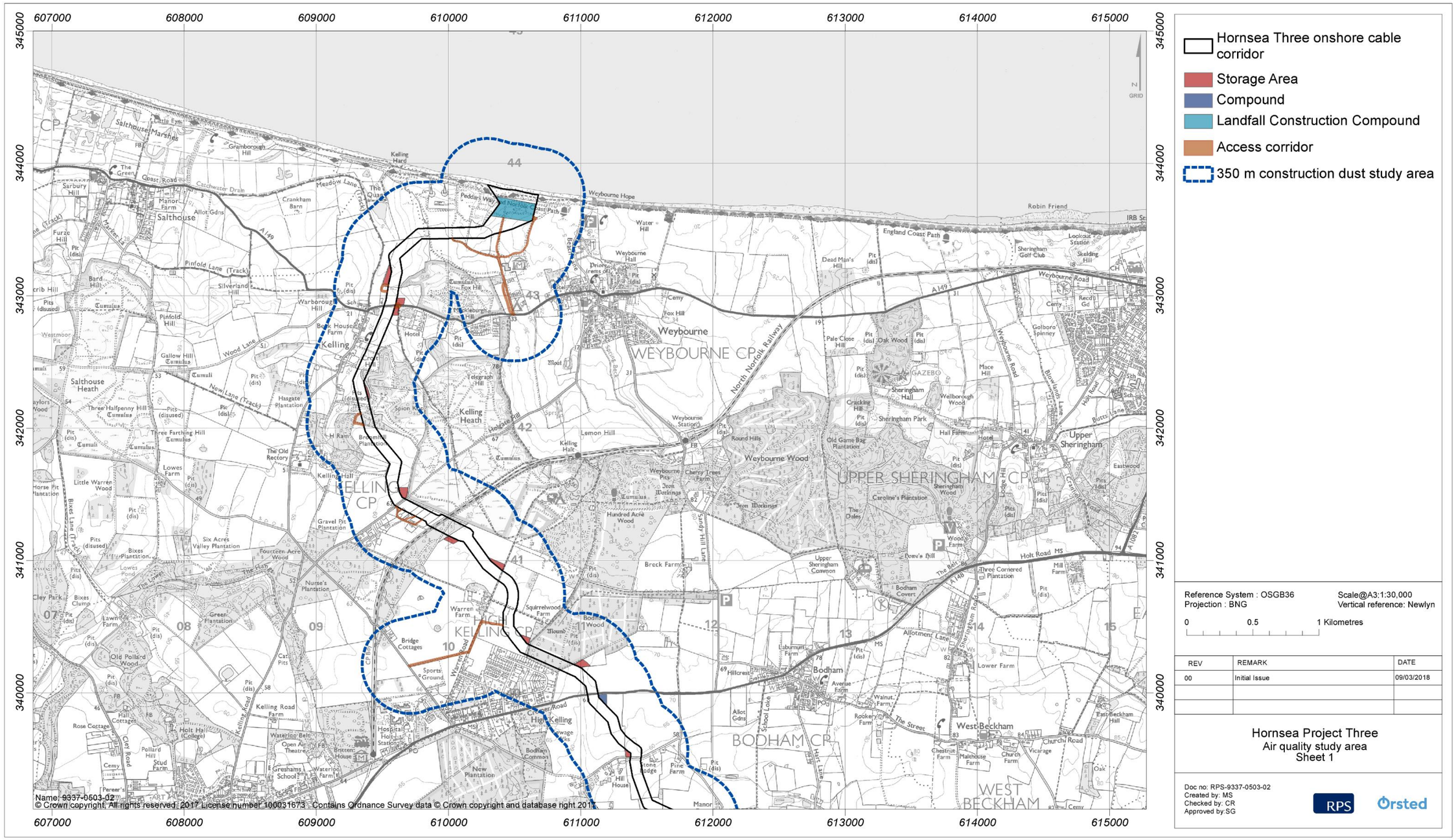
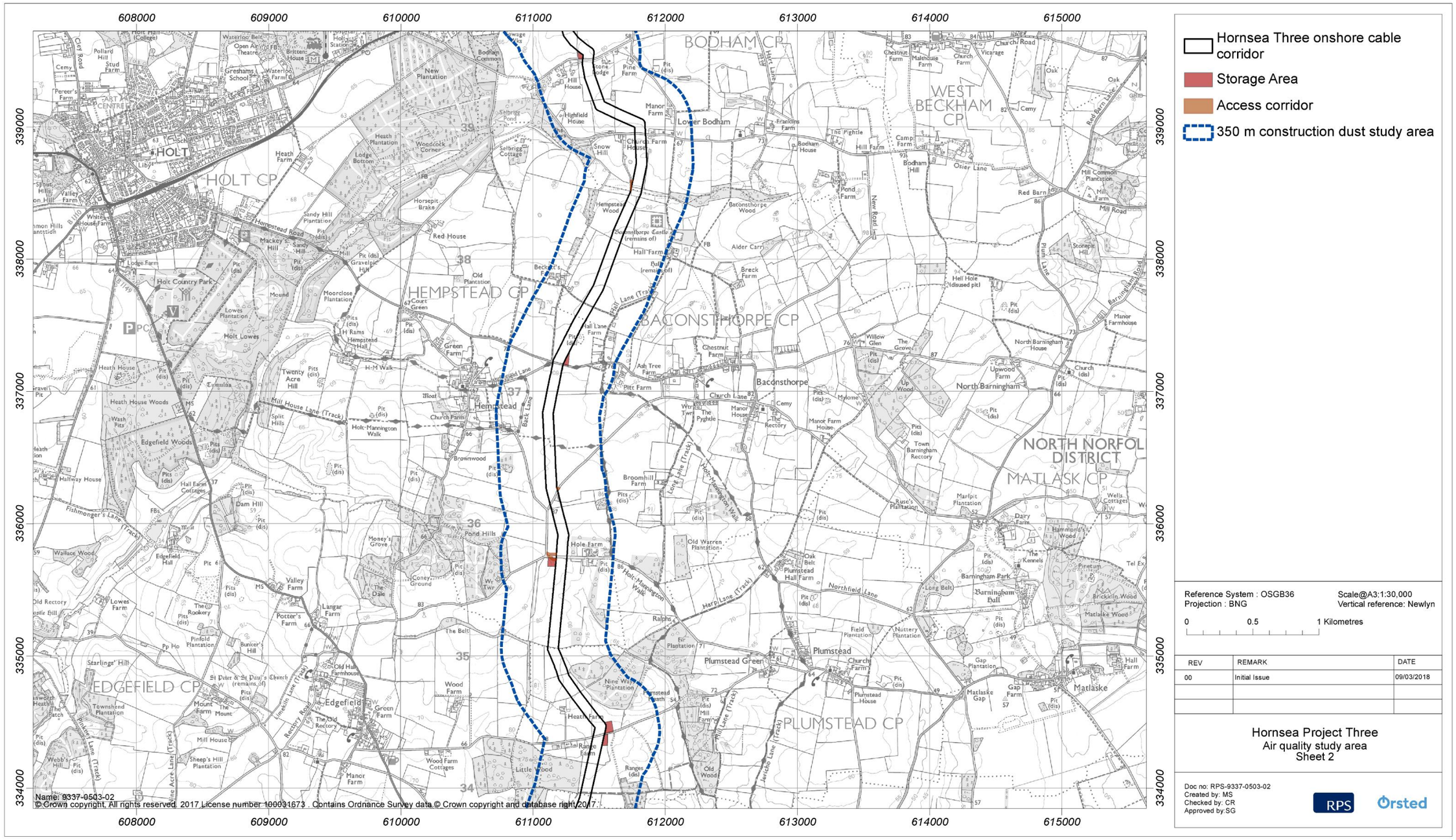


Figure 9.1: Hornsea Three air quality study areas.



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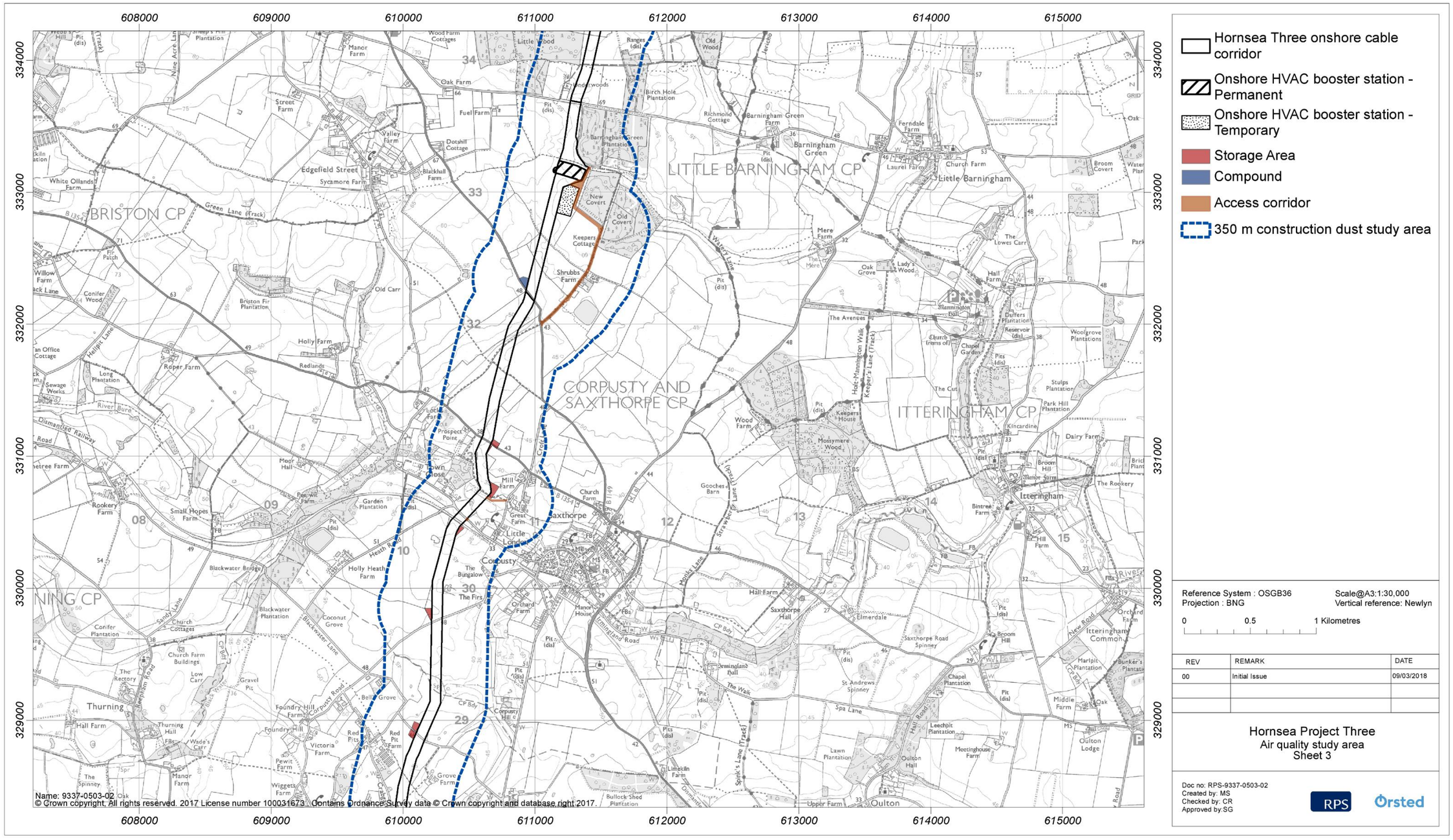

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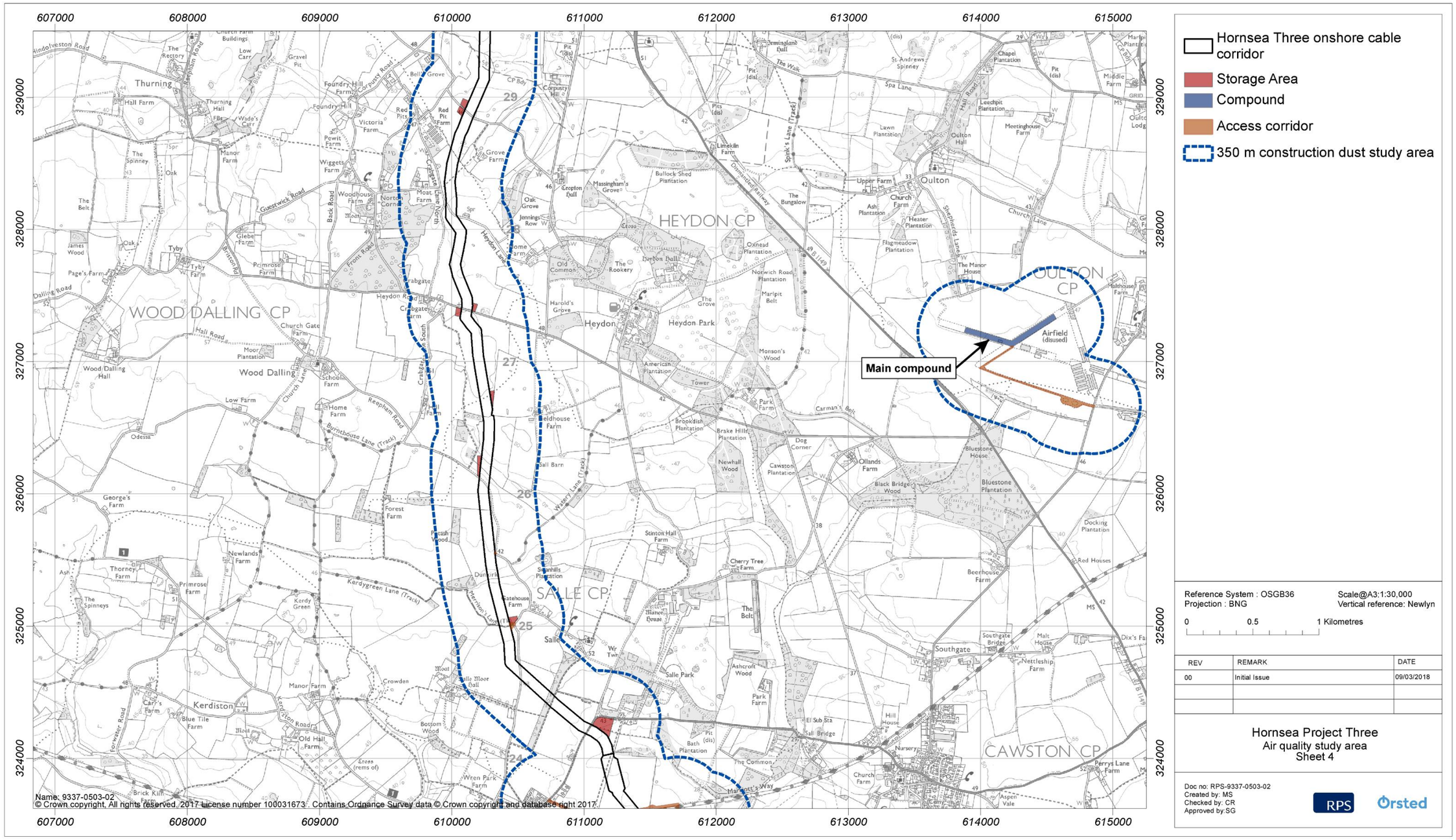

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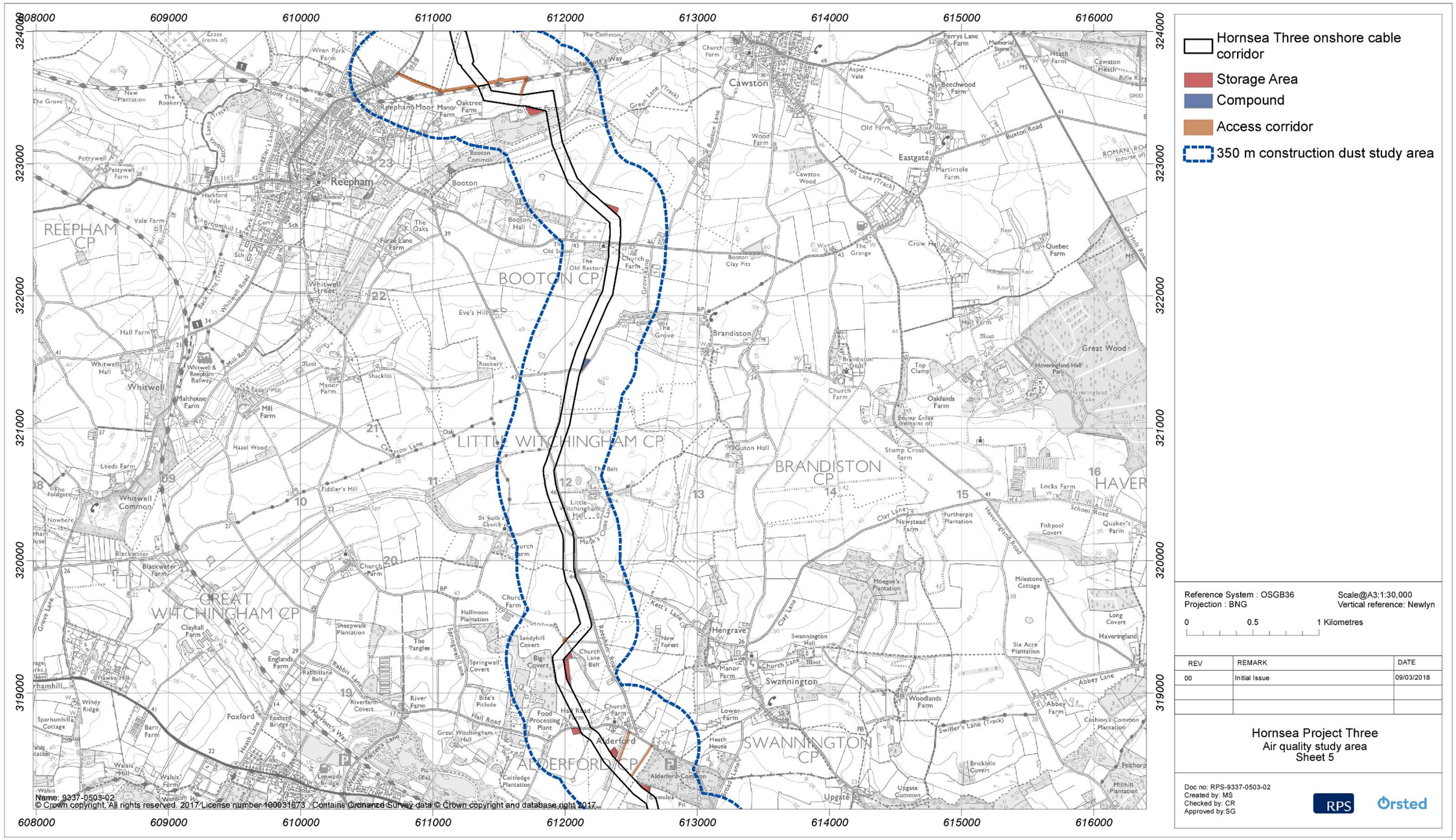

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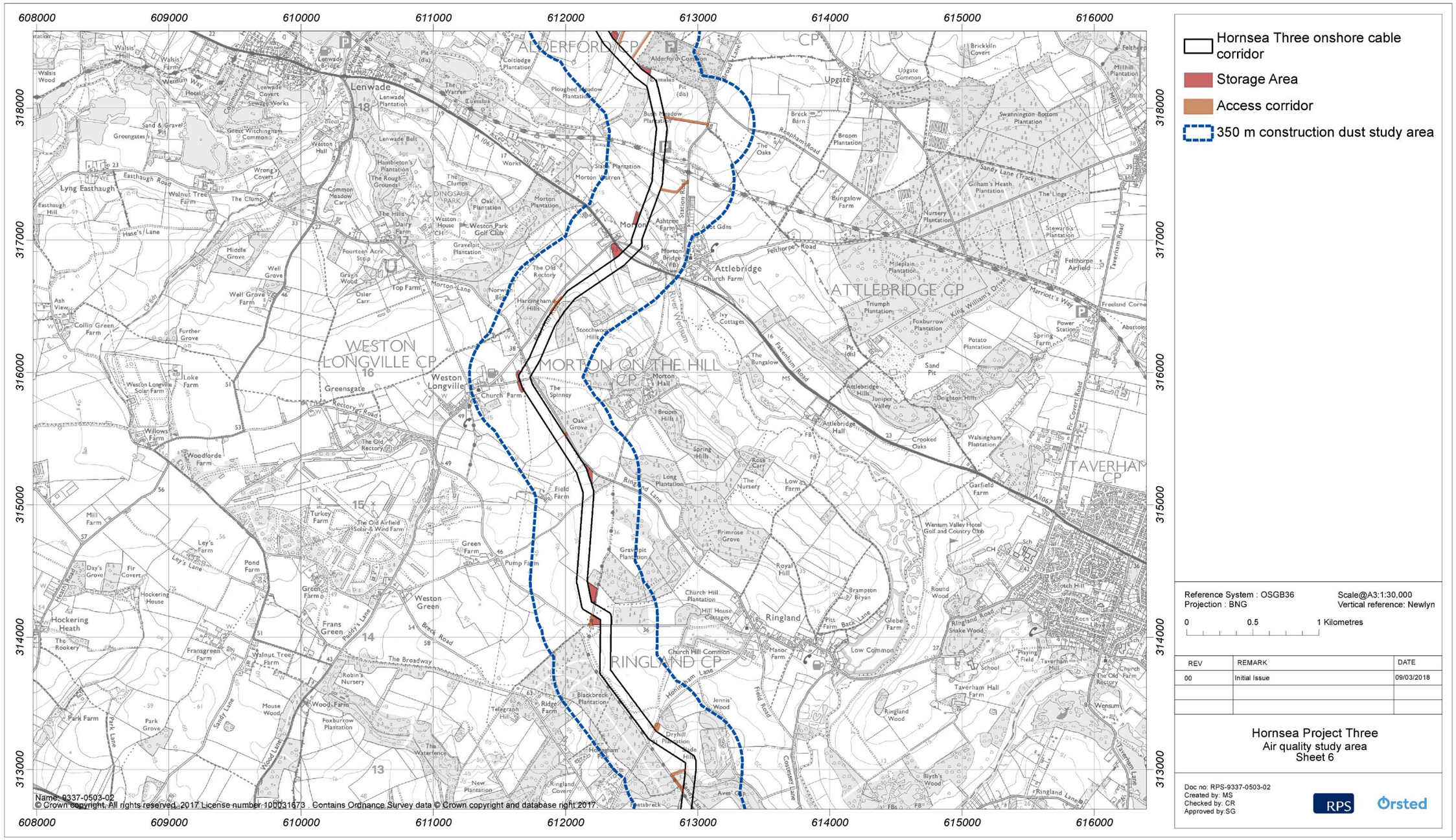

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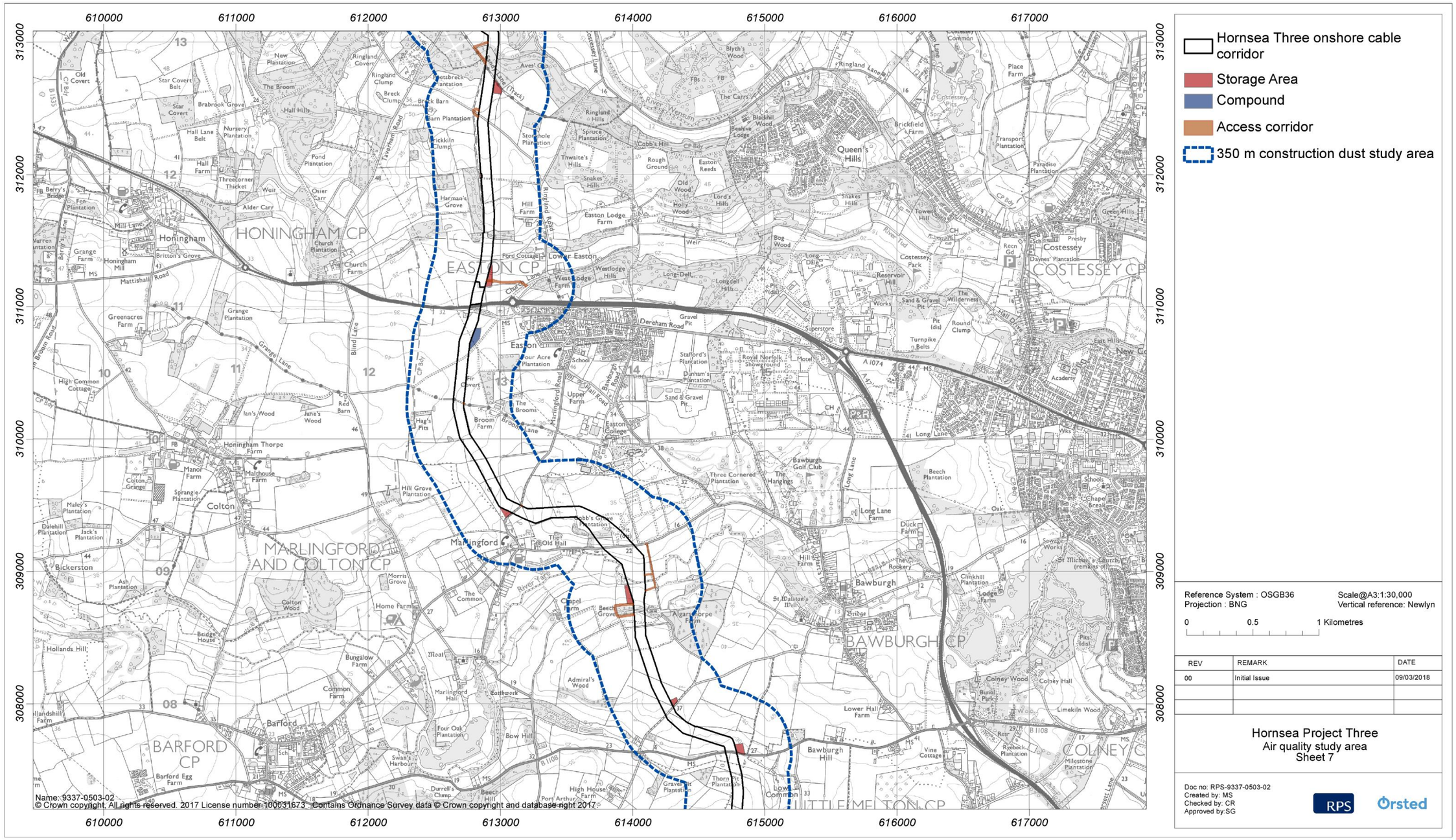

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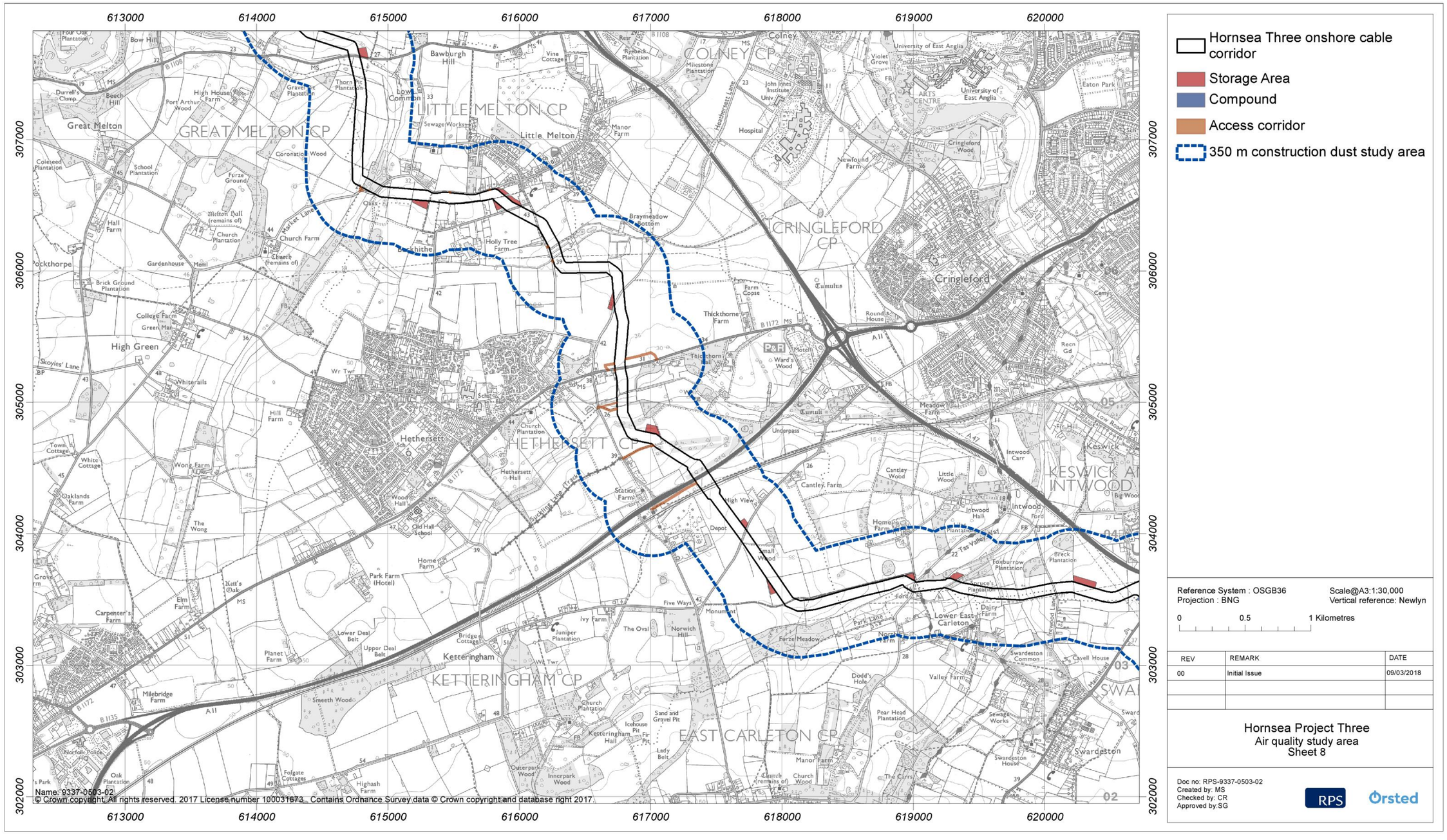

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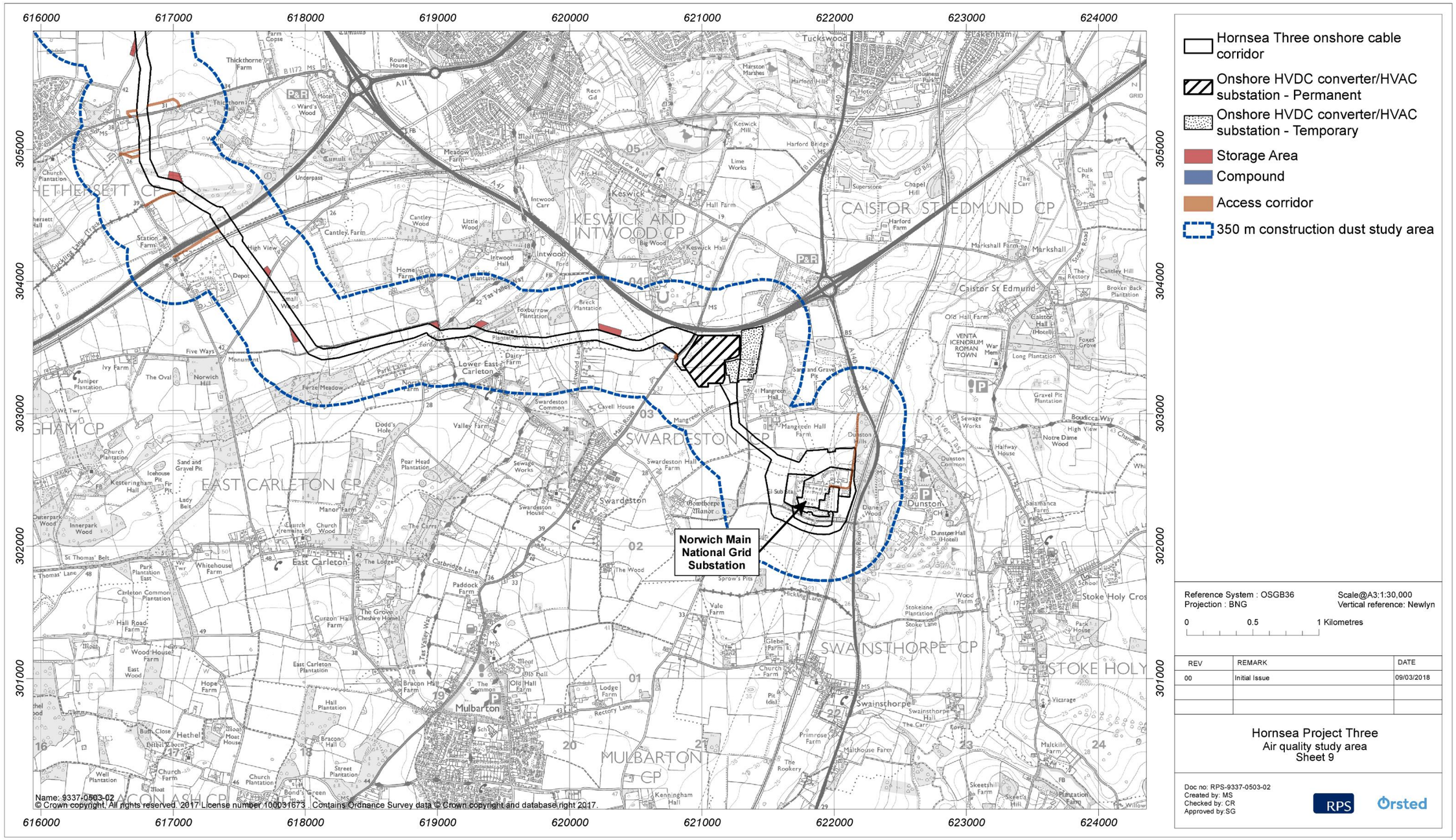

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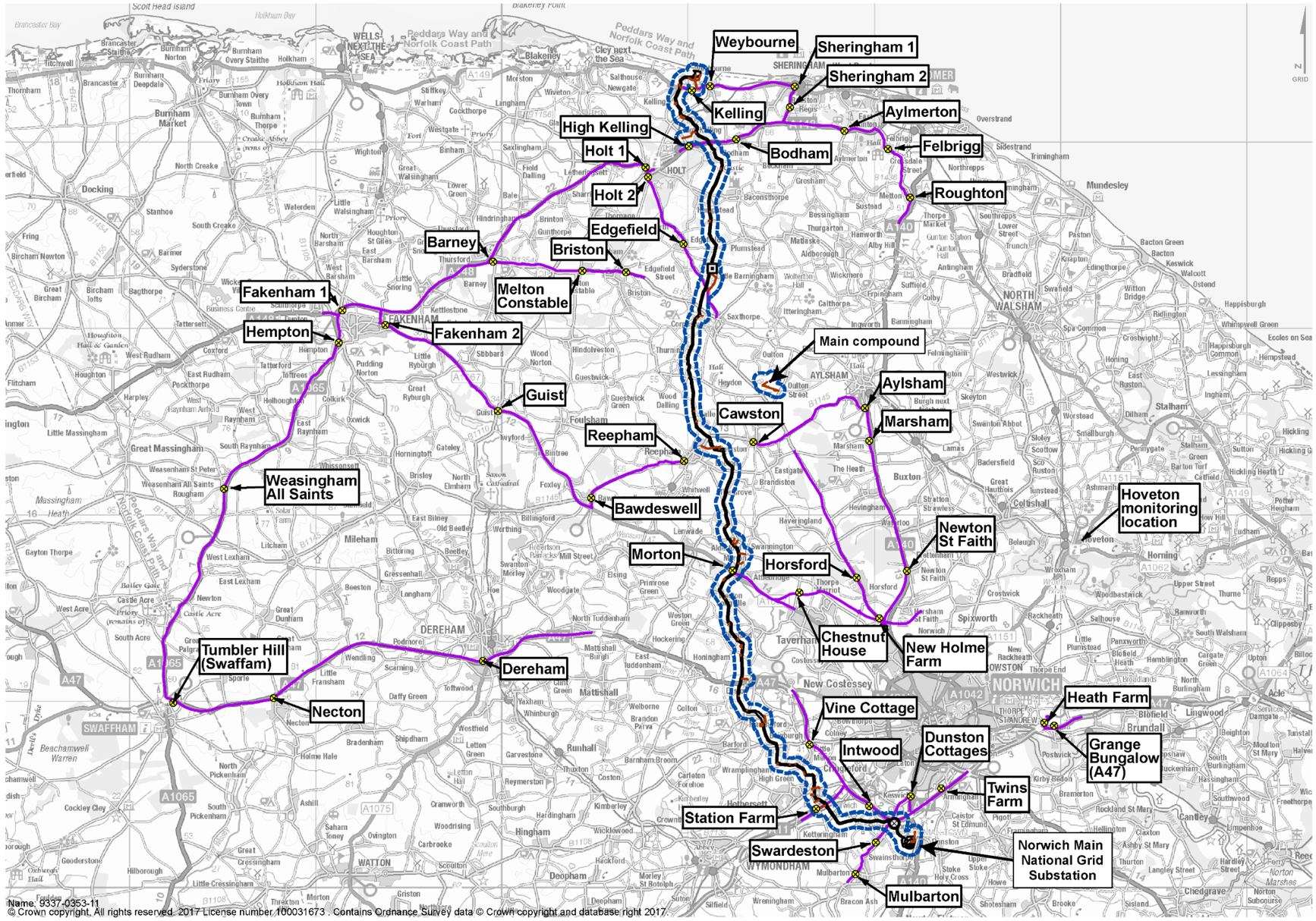


Figure 9.2: Modelled access routes and sensitive receptors.

9.4 Planning policy context

9.4.1 National Policy Statements

9.4.1.1 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).

9.4.1.2 Specifically, the guidance provided within NPS EN-1 and NPS EN-3 was considered, in particular paragraphs 5.2.6 and 5.2.7 of NPS EN-1 (see Table 9.1).

Table 9.1: Summary of NPS EN-1 and NPS EN-3 provisions relevant to air quality.

Summary of NPS EN-1 and NPS EN-3 provision	How and where considered in the Environmental Statement
NPS EN-1 includes generic guidance on the assessment of air quality impacts for major energy projects: *"Where the project is likely to have adverse effects on air quality the applicant should undertake an assessment of the impacts of the proposed project as part of the Environmental Statement."* (paragraph 5.2.6). This requires the Environmental Statement to 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."* (paragraph 5.2.7).	The potential air quality impacts which may arise as a result of Hornsea Three have been described and considered within this chapter. This chapter focuses on the potential impacts from dusts generated by the scheme and considers mitigation and residual effects. The existing air quality levels have been described (see paragraphs 9.7.1 to 9.7.1.2). The predicted impacts on local air quality from dust generated during the construction phase have been described in section 9.11. Impacts from traffic are assessed in section 9.11. NPS EN-1 states that "*Eutrophication from air pollution results mainly from emissions of NOx and ammonia*." For this assessment, the levels of construction traffic are lower than the criteria set out in the Highways Agency (now Highways England) Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA 207/07 Annex F: • Road alignment will change by 5 m or more; • Daily traffic flows will change by 1,000 AADT or more; • HDV flows will change by more than 200 AADT or more; • Daily average speed will change by 10 km/hr or more; • Peak hour speed will change by 20 km/hr or more. Emissions of NO_x and ammonia are not, therefore, considered significant in terms of potential eutrophication impacts and have been scoped out of this assessment.
NPS EN-1 and NPS EN-3 refer to NPS EN-5 as the primary guidance document in relation to onshore grid connection infrastructure. Air quality is not identified as a key impact for such infrastructure within either NPS EN-5 or the offshore wind farm section of NPS EN-3.	For the purpose of this assessment, it has been assumed that the number of vehicles operating during the construction-phase will exceed the IAQM indicative threshold for construction traffic. In addition, it is professional good practice to assess construction dust where there are human receptors within 350 m of the boundary of the site or 50 m of the routes used by construction traffic, or routes used by construction traffic within 500 m from the site boundary. For this reason, air quality has been considered despite the fact that it is not identified by the NPSs as a key impact for such infrastructure.

9.4.1.3 NPS EN-3 also highlights a number of factors relating to the determination of an application and in relation to mitigation. The only relevant point for air quality is summarised in Table 9.2.

Table 9.2: Summary of NPS EN-3 policy on decision-making relevant to air quality.

Summary of NPS EN-3 policy on decision making (and mitigation)	How and where considered in the Environmental Statement
EN-3 states that *"Where the applicant has identified a precise route for the cable from the wind farm to a precise location for the onshore substation and connection to the transmission network, the EIA should assess the effects of the cable."* (paragraph 2.6.37). This guidance applies to all the disciplines within the EIA and is not specific to air quality impact assessment.	In section 9.11, the air quality assessment considers potential impacts of dusts on sensitive receptors within the Hornsea Three air quality (construction dust) study area (within which the Hornsea Three onshore cable corridor is situated).

9.4.2 Other relevant policies

9.4.2.1 Other planning policy relevant to this chapter includes:

- National Planning Policy Framework (NPPF) (2012);
- Web based Planning Practice Guidance provided by the Department for Communities and Local Government (DCLG);
- North Norfolk District Council Core Strategy (2008);
- Breckland Council Adopted Core Strategy (2009); and
- Joint Core Strategy for Broadland, Norwich and South Norfolk (2014).

9.4.2.2 Key provisions of these policies are set out in Table 9.3 along with details as to how these have been addressed within the assessment.

Table 9.3: Summary of other relevant policies relevant to air quality.

Summary of provision	How and where considered in the Environmental Statement
National Planning Policy Framework	
"*[T]he planning system should contribute to and enhance the natural and local environment by … preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution.*" (paragraph 109).	The potential for Hornsea Three to result in significant effects associated with air pollution is assessed in section 9.11.
"*Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan*" (paragraph 124).	Air Quality Management Areas and their relationship to the Hornsea Three (construction dust and traffic emissions) study area are discussed in paragraph 9.7.1.2.
"*To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account*" (paragraph 120).	The site selection process is outlined in volume 1, chapter 4: Site Selection and Consideration of Alternatives. Air quality impacts are assessed in section 9.11 and cumulative impacts are assessed in section 9.13.
National Planning Practice Guidance	
The NPPG states that when deciding whether air quality is relevant to a planning application, considerations could include whether the development would: • *"Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area;* • *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.* • *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.* • *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*	How, if applicable, the adjacent considerations are addressed in this Environmental Statement are outlined below: • Hornsea Three will not introduce any long-term point sources of air pollution. Any temporary point sources of air pollution (e.g. construction plant) are assessed in section 9.11.1 and air quality impacts associated with traffic are assessed in section 9.11.1. • It is not considered likely that Hornsea Three will introduce new people to become exposed to existing sources of air pollutants. • An assessment on air quality impacts, including dust impacts, on sensitive receptors is included in section 9.11
NPPG advises that "*[a]ssessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific.*"	The air quality assessment that has been undertaken as part of the Hornsea Three EIA process has taken into account locationally specific factors relating to nearby receptors, pollutant pathways and emissions sources associated with the Hornsea Three.
The NPPG provides advice on how air quality impacts can be mitigated and notes "*Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation so as to ensure the new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met. Examples of mitigation include… controlling dust and emissions from construction, operation and demolition…*"	Local planning authorities have been consulted throughout the EIA process. Consultation relevant to air quality, including that focused on mitigation, is outlined in Table 9.4.
UK plan for tackling roadside nitrogen dioxide concentrations	
Published by Defra in July 2017, this document describes the Government's plans for bringing roads with NO_2 concentrations above the EU Limit Value back into compliance within the shortest possible time.	As of March 2018, 45 Local Authorities have been identified as needing to take action to reduce NO_2 concentrations on their road networks. The Hornsea Three air quality (construction dust and traffic emissions) study areas do not fall within any of these 45 Local Authorities. As such, the Environmental Statement does not consider the UK Plan further.
Local Planning Policy	
The North Norfolk Local Plan (North Norfolk District Council, 2008) sets out a number of aims and objectives, including "*To improve river water quality and minimise air, land and water pollution*" (Core Aim 3, North Norfolk Local Plan).	Measures to minimise air pollution are outlined in Table 9.29.
The North Norfolk Local Plan states that "*proposals will only be permitted where, individuals or cumulatively, there are no unacceptable impacts on; … air quality*" (Policy EN 13, North Norfolk Local Plan).	Any significant adverse effects identified by this assessment will be mitigated to ensure that there are no unacceptable impacts on air quality. Assessment of air quality impacts along with suggested mitigation are outlined in section 9.11. A summary of the findings of this chapter is in provided in section 9.16 and a summary air quality impacts and mitigation and monitoring is provided in Table 9.41.
The Breckland Council Adopted Core Strategy (Breckland Council, 2009) includes a policy relevant to air quality; "*Development should minimise any unavoidable adverse effects on air quality" (Policy CP 8: Natural Resources, Breckland Council Adopted Core Strategy)*	Measures to minimise air pollution are outlined in Table 9.29.

Summary of provision	How and where considered in the Environmental Statement
The South Norfolk and Broadland Council Joint Core Strategy (Greater Norwich Development Partnership, 2014) sets out a spatial planning objective relevant to air quality; "To protect, manage and enhance the natural, built and historic environment, including key landscapes, natural resources and areas of natural habitat or nature conservation value" (Spatial planning policy objective 9, Joint Core Strategy for Broadland, Norwich and South Norfolk, 2014)	Measures integrated into Hornsea Three to minimise air pollution are outlined in Table 9.29. Additional measures are set out in the Outline CoCP (document reference A8.5) which accompanies the application.

9.5 Consultation

9.5.1.1 Table 9.4 below summarises the issues raised relevant to air quality, which have been identified during consultation activities undertaken to date. Table 9.4 also indicates either how these issues have been addressed within this Environmental Statement or how the Applicant has had regard to them. Further information on the consultation activities undertaken for Hornsea Three can be found in the Consultation Report (document reference number A5.1) that accompanies the DCO application.

Table 9.4: Summary of key consultation issues raised during consultation activities undertaken for Hornsea Three relevant to air quality.

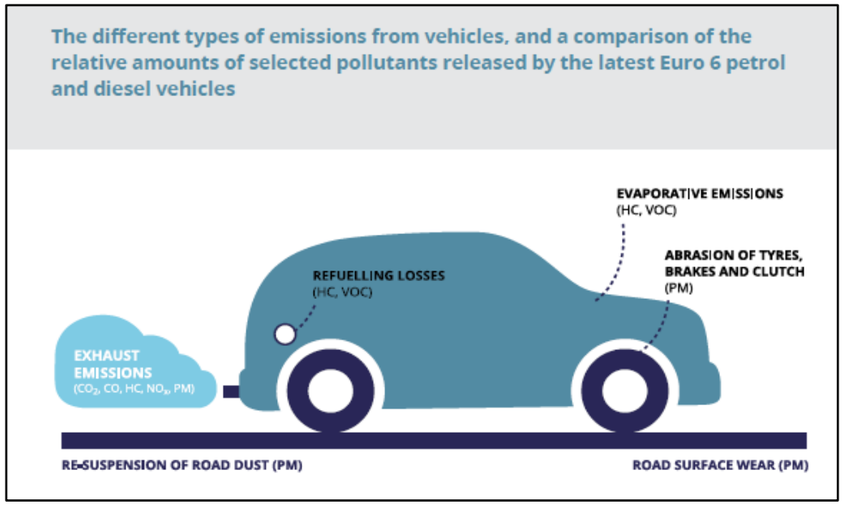
Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
December 2016	PINS Scoping Opinion	The Secretary of State recommends that the Hornsea Three air quality study area, methodology and choice of air quality and health receptors are agreed with the relevant consultees and should have regard to recognised standards and guidance. The Scoping Report confirms that the Applicant does not propose to undertaken air quality monitoring to ascertain the baseline; instead the approach is to rely upon existing publicly available data sources. The Applicant should ensure that the air quality data used to inform the baseline assessment is up to date, sufficiently detailed and has adequate coverage of the study area. Table 12.13 makes reference to the demolition of buildings as part of the decommissioning phase. It is not clear that this has been consistently considered in decommissioning activities have been consistently considered throughout the Scoping Report. Such works should be included in the list of works in the project description to ensure that all sections of the Scoping Opinion assess the demolition impacts. It also mentioned buildings to be constructed. Should these be buildings which are not substations, these should also be listed in the works. The Environmental Statement should assess decommissioning activities consistently for each topic. Table 12.13 makes reference to 'dust' instead of 'dust' throughout. This should be rectified. The Secretary of State welcomes the provision of a Code of Construction Practice (CoCP) and decommissioning plan to be developed as part of the DCO application. The Secretary of State recommends that a draft version of these plans is provided with the DCO application. The Applicant should ensure that any specific measures relied upon to support the outcome of the assessment are appropriately detailed and secured in the CoCP or other suitable plans.	This air quality assessment has been based on recognised standards and practice. No air quality monitoring has been undertaken and suitable and sufficient baseline data have been sourced from existing publicly available data sources. The approach to the air quality assessment has been developed in consultation with Norfolk County Council and the district authorities prior to carrying out the assessment. Agreement was sought on: • The acceptability of the methodology used in the Environmental Statement for assessing dust in the construction, operation and maintenance, and decommissioning phases (including an assessment of the impacts associated with demolition); and • An appropriate methodology for assessing vehicle emissions in the construction, operational and decommissioning phases. Mitigation measures for the decommissioning phase are captured in a decommissioning plan. The draft content of the decommissioning plan has been set out in the Environmental Statement however the plan itself will not be submitted at the application stage.
September 2017	South Norfolk District Council - Section 42 Response	The Council has raised concerns over the potential for dust to be generated during the construction phase, particularly in dry windy weather, The PEIR outlines measures that will be taken to address the issue which are considered acceptable but the details will need to be agreed at the appropriate time.	Mitigation applied in the air quality assessment has been derived from guidance published by the Institute of Air Quality management, and tailored for Hornsea Three (see Table 9.29) The IAQM guidance states that with good dust management and mitigation practises implemented, the effects will be reduced to a level that is "**not significant**" these measures will be implemented through the Outline CoCP (document reference A8.5).
September 2017	Natural England – Section 42 Response	Dust is not only a potential issue in itself but also may carry nutrients and pollutants, similarly to runoff. This could have greater impact on ecological receptors than the dust per se and this should be recognised. Where dust settles it will have the potential to run off into watercourses with impacts as for run off, but potentially away from any mitigation or monitoring and so onsite control, including all exposed soils, will be vital.	The air quality assessment (see section 9.11) has noted that Hornsea Three is within close proximity to five ecological statutory designated sites and has classified the surrounding area as highly sensitive as part of the impact assessment on ecological receptors. Mitigation (see Table 9.29) has been derived from guidance published by the Institute of Air Quality management and tailored for Hornsea Three. The IAQM guidance states that with good dust management and mitigation practises implemented, the residual effects will normally be reduced to a level that is "**not significant**". All of the mitigation measures relate to methods of preventing dust (and associated nutrients/ pollutants) from leaving the site.

9.6 Methodology to inform the baseline

9.6.1 Summary of Key Pollutants Considered

9.6.1.1 For the construction phase of Hornsea Three, the key pollutant is dust, covering both the suspended particulate matter (PM_{10}) fraction in the air that can be breathed, and the deposited dust that has fallen out of the air onto surfaces and which can potentially cause temporary annoyance effects.

9.6.1.2 Regarding exhaust emissions from traffic associated with the construction-phase and decommissioning phase of Hornsea Three, the main pollutants with potential for local air quality impacts are nitrogen oxides (NO_x) and particulate matter (PM_{10}) (see Figure 9.3). Emissions of total NO_x from combustion sources comprise nitric oxide (NO) and NO_2. The NO oxidises in the atmosphere to form NO_2, which is the oxide of concern. The assessment of traffic emissions therefore focuses on changes in NO_2 and PM_{10} concentrations. The impact from fine particulate matter, known as $PM_{2.5}$ (a subset of PM_{10}) concentrations have also been considered.



Source: European Environment Agency (2016) Explaining Road Transport Emissions: A Non-technical Guide.

Figure 9.3: Types of Vehicle Emissions.

9.6.2 Desktop study

9.6.2.1 A large proportion of the total pollutant concentration is usually made up of the background concentration. It is therefore important that the background concentration selected for the assessment is realistic to avoid inaccurate results. Such background data may come from local monitoring studies or from national or government sources, including Defra`s national pollution maps. National Planning Practice Guidance and EPUK & IAQM guidance highlights both these as potential sources of information on background air quality. Government guidance produced by Defra (2018a), Local Air Quality Management Technical Guidance (TG16) (LAQM.TG16), recommends that Defra mapped concentration estimates are used in the first instance to inform background concentrations in air quality modelling.

9.6.2.2 For the purpose of Hornsea Three, the baseline air quality has been determined using publicly available monitoring and mapped data. This approach has been agreed with key stakeholders including Norfolk County Council and the local planning authorities.

9.6.2.3 Table 9.5 sets out a summary of the sources of information used to characterise the baseline for NO_2 and particulate matter (PM_{10} and $PM_{2.5}$) which has then been used to inform the assessment of construction dust and vehicle emissions within the Hornsea Three air quality (construction dust and traffic emissions) study areas.

Table 9.5: Summary of key desktop sources.

Source	Details	Year	Author
Defra, which produces projections of pollutant concentrations for years from 2015 to 2030 for each 1 km grid square in the UK.	https://uk-air.defra.gov.uk/data/laqm-background-home	2015	Defra
Air Quality Review and Assessment documents prepared by North Norfolk District Council.	https://www.north-norfolk.gov.uk/media/3445/asr-2017.pdf	2017	North Norfolk District Council
Air Quality Review and Assessment documents prepared by Broadlands District Council.	https://www.broadland.gov.uk/downloads/file/924/updating_and_screening_assessment_2015	2015	Broadland District Council
Air Quality Review and Assessment documents prepared by South Norfolk District Council.	https://www.south-norfolk.gov.uk/sites/default/files/South%20Norfolk%20ASR%202017.pdf	2017	South Norfolk District Council

Identification of designated sites for air quality

9.6.2.4 Defra maintains a list (Defra, 2018b) of Air Quality Management Areas (AQMAs) that have been designated by Local Authorities. There are no AQMAs within the Hornsea Three air quality (construction dust assessment and traffic emissions) study areas.

9.6.3 Site specific surveys

9.6.3.1 The baseline characterisation provided by the desktop survey is considered sufficient to inform the assessment and therefore no site-specific monitoring surveys have been considered necessary to inform the EIA for air quality, and the methodology applied to the baseline characterisation was agreed during the EIA scoping phase.

9.6.3.2 In this regard, it is noted that no requirements to undertake site-specific monitoring surveys were requested by the Environmental Health Officers of North Norfolk District Council, Broadland District Council, South Norfolk District Council or Norfolk County Council during the consultation process as part of their response to S42 consultation.

9.7 Baseline environment

9.7.1 Air quality

9.7.1.1 This section reviews the air quality conditions within the Hornsea Three air quality (construction dust and traffic emissions) study areas.

9.7.1.2 Air quality in North Norfolk, Broadland and South Norfolk is generally very good based on publicly available data published by Defra and BDC, North Norfolk District Council, and South Norfolk District Council. There are no designated AQMAs within these districts, as concentrations of all pollutants are below the relevant objective and limit values; in consequence, there are no AQMAs within the Hornsea Three air quality (construction dust and traffic emissions) study areas.

9.7.2 Nitrogen Dioxide (NO_2)

Baseline Monitoring NO_2 Data

9.7.2.1 Monitors at urban background locations measure concentrations away from the local influence of emission sources and are therefore broadly representative of residential areas within large conurbations. Monitoring at local urban background locations is considered an appropriate source of data for the purposes of describing baseline air quality for Hornsea Three.

9.7.2.2 North Norfolk District Council carried out diffusion tube monitoring at one urban background location (Hoveton 11 NGR: 631129 318621 (see Figure 9.2)) up to 2013 when monitoring ceased. The most recent measured annual-mean concentrations measured at the urban background location are shown in Table 9.6. Following the publication of its most recent Air Quality Annual Status Report in 2017, North Norfolk District Council restarted roadside monitoring in 2016; however, no monitoring is currently being conducted at urban background locations. Broadland District Council and South Norfolk District Council do not monitor NO_2 background locations. Therefore, only the NO_2 data from North Norfolk District Council (Table 9.6) and Defra NO_2 background map data (Table 9.7) have been used to inform the assessment of NO_2.

Table 9.6: Monitored annual-mean NO_2 concentrations ($\mu g.m^{-3}$).

Site Location	Monitored annual-mean background concentrations ($\mu g.m^{-3}$)				
	2009	2010	2011	2012	2013
Hoveton 11 (urban background)	12.5	20.5	18.1	14.7	15.1

9.7.2.3 The monitored annual-mean NO_2 concentrations ranged from 12.5 to 20.5 $\mu g.m^{-3}$, which are well below the Air Quality Strategy (AQS) objective and Limit Value of 40 $\mu g.m^{-3}$.

Defra NO_2 background data

9.7.2.4 Defra provides estimates of NO_2 concentrations across the UK on maps with a spatial resolution of 1 km^2, for each year from 2015 to 2030. These concentration estimates are smaller in magnitude each year into the future. To keep this assessment conservative, the average annual-mean NO_2 concentration estimate in 2015 for the Hornsea Three air quality (construction dust and traffic emissions) study area has been calculated and used. The overall average background Defra pollutant concentration estimate of NO_2 is provided in Table 9.7.

Table 9.7: Defra mapped annual-mean background NO_2 concentration estimate ($\mu g.m^{-3}$).

Pollutant	Defra mapped background NO_2 concentration estimate for the Hornsea Three air quality (construction dust and traffic emissions) study area for 2015 ($\mu g.m^3$)
NO_2	9.1

9.7.2.5 The average estimated background Defra NO_2 concentration across the air quality study areas is well below the annual mean AQS objective of 40 $\mu g.m^{-3}$.

Selection of appropriate background NO_2 concentration

9.7.2.6 As noted in section 9.7.2.1 and 9.7.2.3 monitoring data at the Hoveton 11 urban background diffusion tube (NGR 631129 318621) indicate that NO_2 concentrations within the Hornsea Three air quality (construction dust and traffic emissions) study area ranges between 12.5 to 20.5 µg.m^{-3}. The Defra estimate of background concentrations in the study area is 9.1 µg.m^{-3} (Table 9.5).

9.7.2.7 Given that the Hornsea Three air quality (construction dust and traffic emissions) study area is primarily located in a rural rather than urban area, the Defra estimate of 9.1 µg.m^{-3} is considered to be most appropriate (average total nitrogen oxides (NO_x) concentrations in rural locations are likely to be lower than urban background locations).

9.7.3 Particulate Matter (PM_{10} and $PM_{2.5}$)

Baseline Monitoring PM_{10} and $PM_{2.5}$ data

9.7.3.1 Dust is the generic term used to describe particulate matter in the size range 1-75 µm in diameter (British Standards Institute, 1983). Particles greater than 75 µm in diameter are termed grit rather than dust.

9.7.3.2 Dusts can contain a wide range of particles of different sizes. The normal fate of suspended (i.e. airborne) dust is deposition. The rate of deposition depends largely on the size of the particle and its density; together these influence the aerodynamic and gravitational effects that determine the distance it travels and how long it stays suspended in the air before it settles out onto a surface. In addition, some particles may agglomerate to become fewer, larger particles; whilst others react chemically.

9.7.3.3 The effects of dust are linked to particle size and two main categories are usually considered:

- PM_{10} particles, those up to 10 µm in diameter, remain suspended in the air for long periods and are small enough to be breathed in and so can potentially impact on health; and
- Dust, generally considered to be particles larger than 10 µm which fall out of the air quite quickly and can soil surfaces (e.g. a car, window sill, laundry). Additionally, such deposited dust can potentially have adverse effects on vegetation and fauna at sensitive habitat sites.

9.7.3.4 North Norfolk District Council, Broadlands District Council and South Norfolk District Council do not monitor PM_{10} or the finer sub-set of PM_{10} comprising particulates up to 2.5 µm diameter ($PM_{2.5}$)

Defra PM_{10} and $PM_{2.5}$ background data

9.7.3.5 The average annual-mean PM_{10} and $PM_{2.5}$ concentration estimate in 2015 for the Hornsea Three air quality (construction dust and traffic emissions) study areas have been calculated. For the air quality study areas, the overall average background Defra pollutant concentration estimates of PM_{10} and $PM_{2.5}$ are provided in Table 9.8.

Table 9.8: Defra Mapped Annual-Mean Background PM_{10} and $PM_{2.5}$ Concentration Estimates (µg.m^{-3}).

Pollutant	Defra mapped background PM_{10} and $PM_{2.5}$ concentration estimate for the Hornsea Three air quality (construction dust and traffic emissions) study area for 2015 (µg.m^3)
PM_{10}	14.1
$PM_{2.5}$	9.3

9.7.3.6 The average estimated background Defra concentrations of PM_{10} and $PM_{2.5}$ across the air quality study areas are well below the annual mean objectives of 40 µg.m^{-3} and 25 µg.m^{-3}, respectively.

Selection of appropriate background particulate matter concentration

9.7.3.7 In the absence of PM_{10} and $PM_{2.5}$ monitoring, the background annual-mean concentration within the Hornsea Three air quality (construction dust) study area has been derived from the Defra mapped background concentration estimate.

9.7.4 Future baseline scenario

9.7.4.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires 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 Environmental Statement.

9.7.4.2 In the event that Hornsea Three does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

9.7.4.3 Historically, the view has been that background traffic-related NO_2 concentrations in the UK would reduce over time, due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on emissions. However, the results of recent monitoring across the UK suggest that background annual-mean NO_2 concentrations have not decreased in line with expectations. Inspection of the results of local monitoring presented here indicates that there is no particular trend over time for concentrations of NO_2.

9.7.4.4 To ensure that the assessment presents conservative results, no reduction has been assumed for the background NO_2, PM_{10} or $PM_{2.5}$ concentrations for future years.

9.7.4.5 Table 9.9 summarises the annual-mean background concentrations for NO_2, PM_{10} and $PM_{2.5}$ used in this assessment.

Table 9.9: Summary of Background Annual-Mean (Long-term) Concentrations used in the Assessment.

Pollutant	Data Source	Concentration (µg.m^{-3})
NO_2	Defra Mapped Estimate (2015)	9.1
PM_{10}	Averaged over entire Hornsea Three air quality (construction dust and traffic emissions) study area	14.1
$PM_{2.5}$		9.3

9.7.5 Data limitations

9.7.5.1 No urban background monitoring of NO_2, PM_{10} or $PM_{2.5}$ currently takes place within any of the Local Authorities that the Hornsea Three air quality (construction dust and traffic emissions) study areas are located. Baseline conditions have therefore been established from Defra's mapped background concentration estimates with due regard given to earlier monitored NO_2 levels. Whilst this does not provide site-specific concentrations of baseline NO_2, PM_{10} or $PM_{2.}$, the published information provides a sufficient level of detail to enable the assessment of impact to be predicted robustly.

9.7.5.2 Transport PM_{10} emissions arise from both the tailpipe exhausts and from other fugitive sources such as brake and tyre wear and re-suspended road dust. Improvements in vehicle technologies are reducing PM_{10} exhaust emissions, therefore, the relative importance of fugitive PM_{10} emissions is increasing. Current official emission factors for particulate matter used in traffic-pollutant modelling does include brake dust and tyre wear as well as the exhaust emissions; however, no allowance is made for re-suspended road dust as its PM_{10} contribution remains unquantified.

9.8 Key parameters for assessment

9.8.1 Maximum design scenario

9.8.1.1 The maximum design scenarios identified in Table 9.10 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in the project description (volume 1, chapter 3: Project Description). Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project Design Envelope, to that assessed here be taken forward in the final design scheme.

9.8.2 Impacts scoped out of the assessment

9.8.2.1 On the basis of the baseline environment and the project description outlined in volume 1, chapter 3: Project Description, a number of impacts are proposed to be scoped out of the assessment for air quality. These impacts are outlined, together with a justification for scoping them out, in Table 9.11.

Table 9.10: Maximum design scenario considered for the assessment of potential impacts on air quality.

Potential impact	Maximum design scenario	Justification
Construction phase		
The temporary impacts during the construction of Hornsea Three may affect receptors sensitive to dust (human and ecological).	<u>Hornsea Three landfall area</u> Open cut at the Hornsea Three landfall area including: • Up to 42,000 m^2 compound area including up to 1,500 m^2 from transition joint bays (based on 250 m^2 x 6); • Up to six cables; and • Corridor width up to 240 m wide (comprising six cables (with installation area up to 15 m) plus up to 20 m separation between each cable. The maximum duration over which works could occur at the landfall would be approximately 5.5 years (assuming a three year gap between the two phases). <u>Hornsea onshore cable corridor</u> • Up to 1,650,000 m^2 (5 m x 55,000 m x 6) from installation of up to six cable trenches; • On average 0.6 m stabilised backfill in each 2 m deep trench; • Up to 99,000 m^2 from jointing bays (based on 440 jointing bays (each jointing bay is 9 m x 25 m)); • Up to 3,960 m^2 from link boxes (based on 440 link boxes (each link box: is 3 m x 3 m)). Link boxes are permanent sub surface structures; • Up to 396,000 m^2 from installation of temporary haul road/access tracks (6 m x 66,000 m per phase); • Up to 120 HDD locations per phase (up to 105 minor HDDs and 15 major HDDs per phase), up to 54,000 m^2 from major HDD compounds (based on 15 HDD compounds (60 m x 60m)) including 15 HDD compounds; • Up to five secondary compounds; • Up to 55 storage areas; and • The haul road would be surfaced with aggregate on geotextile and would be removed at the end of each construction phase. The maximum duration over which construction could occur at the onshore cable corridor would be 5.5 years incorporating two phases (assuming a three-year gap between the two phases). The work in each phase is expected to progress along the Hornsea Three onshore cable corridor with a typical active construction works duration of three months at any particular location.	The maximum design scenario for construction dust impacts would be the HVAC transmission option due to the greater number of cable trenches required and the potential need to construct the onshore HVAC booster station as this would result in the largest area of ground disturbance and therefore the greatest potential for dust generation. The dimensions of the main buildings at the onshore HVDC converter/HVAC substation represent the maximum design scenario as this has the largest footprint and therefore, the largest disturbance from the construction of foundations. The longest onshore construction programme (i.e. eight years) represents the maximum design scenario as this is the longest duration over which dust generation from construction may occur.

Potential impact	Maximum design scenario	Justification
	Onshore HVAC booster station Up to 30,407 m^2 for permanent area of site plus a temporary works area up to 25,000 m^2. Maximum building footprint of 9,000 m^2 (based on single building scenario (120 m length and 75 m width) and height up to 12.5 m). Up to 30,000 m^3 excavated for basement (based on 5m deep and area of 6,000 m^2). The maximum duration over which construction could occur at the onshore HVAC booster station would be five years incorporating two phases assuming a three-year gap with no active construction activity between the two phases. Onshore HVDC converter/HVAC substation Up to 149,302 m^2 for permanent area of site (including an area which may be used for landscaping) plus a temporary works area of 91,000 m^2. Maximum building dimension: up to 220 m length, 75 m width and 25 m height for main buildings The maximum duration over which construction could occur at the onshore HVDC converter/HVAC substation would be six years incorporating two phases assuming a three-year gap with between the two phases. Construction programme The maximum duration of construction for all onshore elements of Hornsea Three would be eight years, which assumes construction across two phases with a three-year gap in-between, as a result of staggered construction of the components (onshore HVAC booster station, onshore HVDC converter/HVAC substation and Hornsea Three onshore cable corridor) and each phase would be preceded by pre-construction activities such as borehole investigations at HDD crossing points.	
The temporary impacts due to traffic may affect human and ecological receptors during the construction phase.	Construction programme The maximum duration of construction for all onshore elements of Hornsea Three would be eight years, which assumes construction across two phases with a three-year gap in-between, as a result of staggered construction of the components (onshore HVAC booster station, onshore HVDC converter/HVAC substation and Hornsea Three onshore cable corridor) and each phase would be preceded by pre-construction activities such as borehole investigations at HDD crossing points. Construction traffic parameters are set out in volume 6, annex 7.6: Construction Vehicle Trip Generation Assumptions.	The IAQM guidance (IAQM, 2014) requires that construction vehicle emissions will need to be assessed for large long-term construction sites that will generate HGV movements in excess of 25 Annual Average Daily Traffic (AADT) movements within an AQMA and 100 AADT movement elsewhere. In practise, the number of vehicles generated by Hornsea Three during the construction phase are likely to exceed this criterion. An assessment of impacts due to traffic emission during the construction phase has been included within this assessment as a maximum design scenario in order to comply with industry guidance
Decommissioning phase		
The temporary impacts of decommissioning of Hornsea Three may affect receptors sensitive to dust (human and ecological).	Cables to be left in place in ground, with end sealed and securely buried.	To minimise the environmental disturbance during decommissioning the onshore cables will be left in place in the ground with the cable ends cut at the onshore substation, sealed and securely buried as a precautionary measure. No works are currently expected to be required for decommissioning along the Hornsea Three onshore cable corridor.
	All elements of the onshore HVAC booster station and HVDC converter/HVAC substation would be removed, site reinstated to original condition or for alternative use.	In practice impacts from decommissioning are likely to be less than during construction. Therefore, assessing impacts during decommissioning on the same basis as impacts during the construction phase represents worst case.

Potential impact	Maximum design scenario	Justification
The temporary impacts due to traffic may affect human and ecological receptors during the decommissioning phase.	The duration of the decommissioning phase for the onshore HVAC booster station and onshore HVDC converter/HVAC substation will be similar to the construction phase.	In practise, the number of vehicles generated by Hornsea Three during the decommissioning phase are likely to be less than during construction. Therefore, assessing impacts during decommissioning on the same basis as impacts during the construction phase represents worst case.

Table 9.11: Impacts scoped out of the assessment for air quality.

Potential impact	Justification
Construction phase	
The impact of Eutrophication from air pollution resulting from emissions of NOx and ammonia (as outlined in National Policy Statement (NPS) EN-1)	The Highways Agency (now Highways England) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1, HA207/07, Annex F provides a detailed methodology for assessing the impact of the deposition of pollutants (e.g. NOx and ammonia) from traffic on designated sites. An assessment is required if any of the following criteria are met: • Road alignment will change by 5 m or more; • Daily traffic flows will change by 1,000 AADT or more; • HDV flows will change by more than 200 AADT or more; • Daily average speed will change by 10 km/hr or more; • Peak hour speed will change by 20 km/hr or more. The traffic generated by the construction and decommissioning phases of Hornsea Three do not exceed any of these criteria. Potential eutrophication impacts have therefore been scoped out of this assessment.
Temporary impacts of demolition during the construction of Hornsea Three that may affect receptors sensitive to dust (human and ecological).	No demolition works are proposed as part of the construction phase of Hornsea Three. As such, an assessment of dust risk from demolition activities has been scoped out of the assessment. Demolition is proposed as part of the decommissioning phase of Hornsea Three; the dust risk assessment related to the decommissioning phase is covered in 9.11.3.
Operation and maintenance phase	
The impacts due to operation and maintenance of the underground onshore cables onshore HVAC booster station and HVDC converter/HVAC substation may affect human and ecological receptors.	The operation of the HVAC booster station and the HVDC converter/HVAC substation is not expected to generate any air emissions during normal operational activities. However, it may generate a small number of staff trips with occasional maintenance vehicle movements. Any routine maintenance of the cables during the operation and maintenance phase would be limited to occasional site inspections at link boxes and therefore, are unlikely to result in any discernible air quality impacts. The number of vehicle movements generated during this phase would be considerably smaller than those for the construction phase and are anticipated to be negligible (see Chapter 7: Traffic and Transport), well below the IAQM indicative thresholds for when an Air Quality assessment for operational traffic movements is expected. As such, an assessment of the operation and maintenance phase, including maintenance activities, of Hornsea Three has been scoped out of this assessment.
The impact of Eutrophication from air pollution resulting from emissions of NOx and ammonia (as outlined in National Policy Statement (NPS) EN-1)	Potential eutrophication impacts have been scoped out of this assessment. Emissions of NOx and ammonia are not expected to be significant (see justification in construction phase).
Decommissioning phase	
The temporary impacts due to traffic may affect human and ecological receptors during the decommissioning phases.	The decommissioning of the Hornsea Three onshore cable corridor and the HVDC converter/HVAC substation is expected to generate significantly less traffic than the construction phase. The number of vehicle movements generated during this phase is anticipated to be negligible, and an assessment of traffic impacts has been scoped out for this phase.
The impact of Eutrophication from air pollution resulting from emissions of NOx and ammonia (as outlined in National Policy Statement (NPS) EN-1)	Potential eutrophication impacts have been scoped out of this assessment. Emissions of NOx and ammonia are not expected to be significant (see justification in construction phase).

9.9 Impact assessment methodology

9.9.1 Overview

9.9.1.1 The air quality EIA has followed the methodology set out in volume 1, chapter 5: Environmental Impact Assessment Methodology. Specific to the air quality EIA, the following guidance documents have also been considered:

- Land-Use Planning & Development Control: Planning for Air Quality (EPUK and IAQM, 2017);
- Guidance on the assessment of dust from demolition and construction (IAQM, 2014); and
- Local Air Quality Management Technical Guidance (Defra, 2016).

9.9.1.2 Environmental Protection UK (EPUK) guidance on the assessment of air quality effects (EPUK and IAQM, 2017) indicates that air quality assessment of construction traffic is likely to be necessary for those large, long-term construction sites that would generate large HGV flows (of over 100 movements per day) over a period of a year or more. Details of the traffic likely to be generated by the onshore elements of Hornsea Three have been set out in chapter 7: Traffic and Transport. Traffic generated during the construction and decommissioning phases of Hornsea Three are predicted to exceed the EPUK indicative thresholds for triggering an assessment of air quality impacts from construction traffic (HGV flows of over 100 movements per day over a period of a year or more) and as such, an assessment of traffic emissions has been undertaken.

9.9.1.3 The Institute of Air Quality Management (IAQM) has issued *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014), which aims to be to estimate the impacts of both PM_{10} and dust through a risk-based assessment procedure. The IAQM guidance document states: *"The impacts depend on the mitigation measures adopted. Therefore, the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified"* (IAQM, 2014, page 4).

9.9.1.4 The IAQM guidance provides a methodological framework, but notes that professional judgement is required to assess effects: "*This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also a wide range of factors affect the amount of dust that may arise, and these are not readily quantified*" (IAQM, 2014, page 30).

9.9.1.5 In addition, the air quality EIA has considered the legislative framework as defined by the following legislation:

- The European Union Framework Directive 2008/50/EC (European Council, 2008);
- The Air Quality Standards Regulations 2010 (AQS Regulations). The regulations implement air quality values prescribed by Directive 2008/50/EC. For the purpose of this assessment, the air quality limit values set out by Regulations have been used (as set out in Table 9.12);
- The current UK Air Quality Strategy (AQS) (Defra, 2007). The strategy describes the Government's strategy for improving air quality in the UK. The strategy sets out air quality objectives, which have been used in this assessment; and
- UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations (Defra 2017) describes the Government's plan for bringing roads with NO_2 concentrations above the EU Limit Value back into compliance within the shortest time possible.

9.9.1.6 The EU limit values and relevant AQS objectives for nitrogen dioxide (NO_2) and particulate matter are summarised in Table 9.12 and are framed as a mass concentration per unit volume of air ($\mu g.m^{-3}$). The deposition of dust from the air onto surfaces, which has no EU or AQS numerical limits or objectives.

Table 9.12: Summary of relevant air quality limit values and objectives.

Pollutant	Averaging Period	Objectives/Limit Values	Not to be exceeded more than	Target Date
Nitrogen dioxide (NO_2)	1 hour	200 $\mu g.m^{-3}$	18 times per calendar year.	N/A
	Annual	40 $\mu g.m^{-3}$	N/A	N/A
Particulate Matter (PM_{10})	24 hour	50 $\mu g.m^{-3}$	35 times per calendar year.	N/A
	Annual	40 $\mu g.m^{-3}$	N/A	N/A
Particulate Matter ($PM_{2.5}$)	Annual	Target of 15% reduction in concentrations at urban background locations.	N/A	Between 2010 and 2020 (a).
		Variable target of up to 20% reduction in concentrations at urban background locations [c].	N/A	Between 2010 and 2020 (b).
	Annual	25 $\mu g.m^{-3}$	N/A	01 January 2020 [a]
		25 $\mu g.m^{-3}$	N/A	01 January 2015 [bb]

Pollutant	Averaging Period	Objectives/Limit Values	Not to be exceeded more than	Target Date
µg.m^{-3} – micrograms per cubic meter. PM_{10} refers to particles with a mean aerodynamic diameter of up to 10 µm. $PM_{2.5}$ refers to particles with a mean aerodynamic diameter of up to 2.5 µm. [a] Target date set in UK Air Quality Strategy 2007 [b] Target date set in Air Quality Standards Regulations 2010. Although the date has passed the limit values remain the same. Neither have they been amended or covered in the Air Quality Standards (Amendment) Regulations 2016. [c] Aim to not exceed 18 µg.m^{-3} by 2020.				

9.9.2 Impact assessment criteria for assessment of construction dust

9.9.2.1 Concentration-based limit values and objectives have been set for the PM_{10} suspended particle fraction, but no statutory or official numerical air quality criterion for deposited dust annoyance or nuisance has been set at a UK, European or World Health Organisation (WHO) level. Construction dust assessments have tended to be risk based, focusing on the appropriate measures to be used to keep dust impacts at an acceptable level.

9.9.2.2 The IAQM dust guidance aims to estimate the impacts of both PM_{10} and deposited dust through a risk-based assessment procedure. The IAQM dust guidance document states: "*The impacts depend on the mitigation measures adopted, Therefore the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified.*"

9.9.2.3 The IAQM dust guidance provides a methodical framework, but notes that professional judgement is required to assess effects: "*This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also a wide range of factors affect the amount of dust that may arise and these are not readily quantified.*"

9.9.2.4 Consistent with the recommendations in the IAQM guidance, a risk-based assessment for dust impacts has been undertaken for Hornsea Three, using the well-established source-pathway-receptor approach:

- The dust impact (the change in dust levels attributable to the development activity) at a particular receptor will depend on the magnitude of the dust source and the effectiveness of the pathway (i.e. the route through the air) from source to receptor;
- The effects of the dust are the results of these changes in dust levels on the exposed receptors, for example annoyance or adverse health effects. The effect experienced for a given exposure depends on the sensitivity of the particular receptor to dust. An assessment of the overall dust effect for the Hornsea Three air quality (construction dust) study area has been made using professional judgement taking into account both the change in dust levels (as indicated by the dust impact risk for individual receptors) and the absolute dust levels, together with the sensitivities of local receptors and other relevant factors for the area.

9.9.2.5 The dust risk categories that have been determined for each of the four activities (demolition, earthworks, construction and trackout) have been used to define the appropriate site-specific mitigation measures based on those described in the IAQM dust guidance. The guidance states that provided the mitigation measures are successfully implemented, the resultant effects of the dust exposure will normally be "*not significant*".

9.9.2.6 This assessment does not consider the air quality impacts of dust from any contaminated land or buildings. The impacts of any contaminated land identified as a result of Hornsea Three is assessed in chapter 1: Geology and Ground Conditions.

9.9.2.7 The organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team have professional affiliations that include Fellow of the Institute of Air Quality Management, Chartered Chemist, Chartered Scientist, Chartered Environmentalist and Member of the Royal Society of Chemistry and have the required academic qualifications for these professional bodies. As such they are considered sufficiently qualified to undertake this assessment.

Source magnitude

9.9.2.8 The IAQM guidance gives examples of the dust emission magnitudes for demolition, earthworks, construction activities and track-out. These example dust emission magnitudes are based on the site area, building volume, number of Heavy Duty Vehicle movements generated by the activities and the materials used. These example magnitudes have been combined with the duration of construction activities and the resulting ranking of source magnitude is set out in Table 9.13.

Table 9.13: Risk allocation – source (magnitude of dust impacts).

Features of the source of dust emissions	Dust emission magnitude
Demolition – building over 50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities > 20 m above ground level. **Earthworks** – total site area over 10,000 m^2, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved > 100,000 tonnes. **Construction** – total building volume over 100,000 m^3, activities include piling, on-site concrete batching, sand blasting. Period of activities more than two years. **Track-out** – 50 HDV outwards movements in any one day, potentially dusty surface material (e.g. High clay content), unpaved road length > 100 m.	Large
Demolition – building between 20,000 to 50,000 m^3, potentially dusty construction material and demolition activities 10 to 20 m above ground level. **Earthworks** – total site area between 2,500 to 10,000 m^2, moderately dusty soil type (e.g. silt), five to ten heavy earth moving vehicles active at any one time, formation of bunds 4 to 8 m in height, total material moved 20,000 to 100,000 tonnes. **Construction** – total building volume between 25,000 and 100,000 m^3, use of construction materials with high potential for dust release (e.g. concrete), activities include piling, on-site concrete batching. Period of construction activities between one and two years. **Track-out** – 10 to 50 HDV outwards movements in any one day, moderately dusty surface material (e.g. High clay content), unpaved road length 50 – 100 m**.**	Medium
Demolition – building less than 20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities < 10 m above ground, demolition during winter months. **Earthworks** – total site area less than 2,500 m^2. Soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 10,000 tonnes earthworks during winter months. **Construction** – total building volume below 25,000 m^3, use of construction materials with low potential for dust release (e.g. metal cladding or timber). Period of construction activities less than one year. **Track-out** – < 10 HDV outwards movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.	Small

Pathway and receptor – sensitivity of the area

9.9.2.9 Pathway means the route by which dust and particulate matter may be carried from the source to a receptor. The main factor affecting the pathway effectiveness is the distance from the receptor to the source. The orientation of the receptors to the source compared to the prevailing wind direction is a relevant risk factor for long-duration construction projects; however, short-term construction projects may be limited to a few months when the most frequent wind direction might be quite different, so adverse effects can potentially occur in any direction from Hornsea Three.

9.9.2.10 As noted in the IAQM guidance, a number of attempts have been made to categorise receptors into high, medium and low sensitivity categories; however, there is no unified sensitivity classification scheme that covers the different types of potential effects on property, human health and ecological receptors and so separate sensitivity categories are used for each of these effects. Table 9.14 and Table 9.15 set out the IAQM basis for categorising the sensitivity of people, property and ecological receptors to dust and PM_{10}.

Table 9.14: Sensitivities of people and property receptors to dust.

Receptor	Sensitivity
Principles: • Users can reasonably expect enjoyment of a high level of amenity; or • The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land. Indicative examples: • Residential properties. • Museums and other culturally important collections. Medium and long-term car parks and car showrooms.	High
Principles: • Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • The appearance, aesthetics or value of their property could be diminished by soiling; or • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Indicative examples: • Parks, places of work.	Medium
Principles: • The enjoyment of amenity would not reasonably be expected; or • There is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative examples: • Playing fields, farmland (unless commercially-sensitive horticultural) • Footpaths and roads • Short-term car parks.	Low

Table 9.15: Sensitivities of people and property receptors to PM_{10}.

Receptor	Sensitivity
Principles: • Locations where members of the public are exposed over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM_{10}, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative examples: • Residential properties. • Schools, hospitals and residential care homes.	High
Principles: • Locations where the people exposed are workers and exposure is over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM_{10}, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative examples: • Office and shop workers (but generally excludes workers occupationally exposed to PM_{10} as protection is covered by Health and Safety at Work legislation).	Medium
Principles: • Locations where human exposure is transient. Indicative examples: • Public footpaths, playing fields, parks. • Shopping streets.	Low

9.9.2.11 Table 9.16 sets out the basis for determining the sensitivity of ecological receptors to dust. For further assessment of ecological impacts see chapter 3: Ecology and Nature Conservation.

Table 9.16: Sensitivities of ecological receptors to dust.

Receptor	Sensitivity
Principles: • Locations with an international or national designation and the designated features may be affected by dust soiling; or • Locations where there is a community of a particularly dust sensitive species such as vascular plant species included in the Red Data List for Great Britain. Examples: • Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	High
Principles: • Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition. Examples: • Site of Special Scientific Interest (SSSI) with dust sensitive features.	Medium
Principles: • Locations with a local designation where the features may be affected by dust deposition Examples: • A Local Nature Reserve, with dust sensitive features.	Low

9.9.2.12 The IAQM methodology combines consideration of the pathway and receptor to derive the sensitivity of the area.

9.9.2.13 Table 9.17, Table 9.18 and Table 9.19 show how the sensitivity of the area has been derived for this assessment using the IAQM approach.

Table 9.17: Sensitivity of the area to dust impacts on people and property.

Receptor Sensitivity	Number of Receptors [a]	Distance from the Source (m) [b]			
		<20	<50	<100	<350
High	**>100**	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	**>1**	Medium	Low	Low	Low
Low	**>1**	Low	Low	Low	Low
	1	Low	Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout.

[a] The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded.

[b] For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.

Table 9.18: Sensitivity of the area to PM_{10} impacts on human health.

Receptor Sensitivity	Annual Mean PM_{10} Concentration [a]	Number of Receptors [b, c]	Distance from the Source (m) [d]				
			<20	<50	<100	<200	<350
High	**> 32 µg.m^{-3}**	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28 - 32 µg.m^{-3}	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24 - 28 µg.m^{-3}	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	< 24 µg.m^{-3}	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	**> 32 µg.m^{-3}**	>10	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	28 – 32 µg.m^{-3}	> 10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	< 28 µg.m^{-3}	>1	Low	Low	Low	Low	Low
Low	**-**	>1	Low	Low	Low	Low	Low

Receptor	Annual Mean	Number of	Distance from the Source (m) [d]
The sensitivity of the area has been derived for demolition, construction, earthworks and trackout. [a] This refers to the background concentration derived from the assessment of baseline conditions earlier in this report. The concentration categories listed in this column apply to England, Wales and Northern Ireland but not to Scotland. [b] The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded. [c] For high sensitivity receptors with high occupancy (such as schools or hospitals), the approximate number of occupants has been used to derive an equivalent number of receptors. [d] For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.			

Table 9.19: Sensitivity of the area to Ecological Impacts.

Receptor Sensitivity	Distance from the Source (m) [a1]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low
The sensitivity of the area has been derived for demolition, construction, earthworks and trackout and for each designated site. [a 1] Only the highest level of area sensitivity has been recorded.		

9.9.2.14 The IAQM dust guidance lists the following additional factors that can potentially affect the sensitivity of the area and, where necessary, professional judgement has been used to adjust the sensitivity allocated to a particular area:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which are considered to go beyond the classifications given in the table above.

9.9.2.15 The matrices in Table 9.20, Table 9.21, Table 9.22 and Table 9.23 have been used to assign the risk for each activity type.

Table 9.20: Risk of dust impacts – demolition.

Sensitivity of Area	Magnitude of Dust Impacts		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 9.21: Risk of dust impacts – earthworks.

Sensitivity of Area	Magnitude of Dust Impacts		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 9.22: Risk of dust impacts – construction.

Sensitivity of Area	Magnitude of Dust Impacts		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 9.23: Risk of dust impacts – trackout.

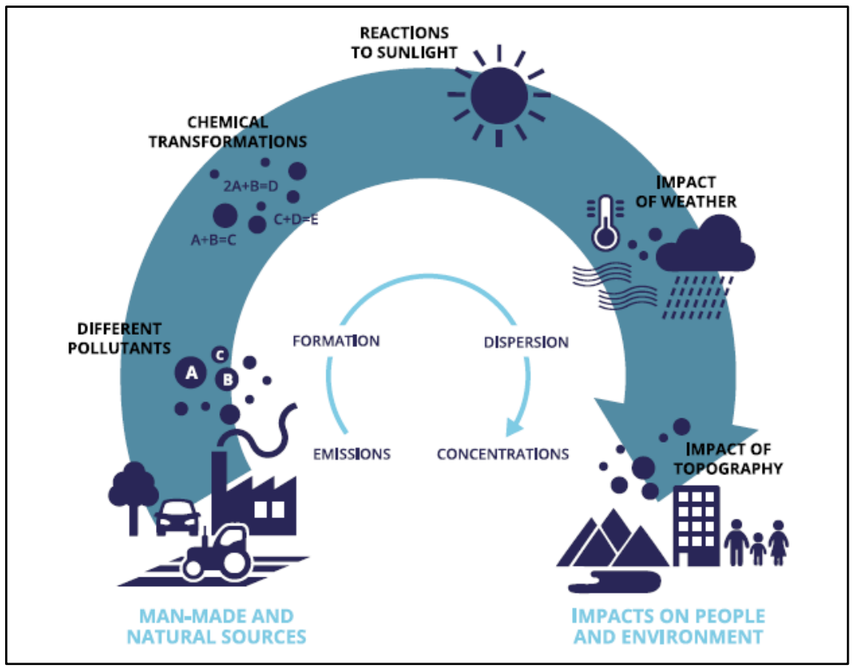
Sensitivity of Area	Magnitude of Dust Impacts		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Negligible
Low	Low Risk	Low Risk	Negligible

9.9.2.16 The dust risk categories that have been determined for each of the four activities above have been used to define the appropriate site-specific dust control measures based on those described in the IAQM guidance. The guidance states that provided the dust control measures are successfully implemented, the resultant effects of the dust exposure will normally be *"not significant"*. For those cases where the risk category is negligible, no dust controls beyond those required by legislation are considered necessary.

9.9.3 Impact assessment criteria for assessment of construction traffic

Atmospheric Dispersion Modelling of Pollutant Concentrations

9.9.3.1 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition (Figure 9.4). An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sub-sections.



Source: European Environment Agency (2016) Explaining Road Transport Emissions: A Non-technical Guide.

Figure 9.4: Air Pollution: From Emissions to Exposure.

9.9.3.2 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels have been described in detail in Section 9.7.

9.9.3.3 The ADMS-Roads model has been used in this assessment to predict the air quality impacts from changes in traffic on the local road network during the construction phase of the Hornsea Three. This is a version of the Atmospheric Dispersion Modelling System (ADMS), a formally validated model developed in the United Kingdom (UK) by Cambridge Environmental Research Consultants Ltd (CERC) and widely used in the UK and internationally for regulatory purposes.

Modelled Scenarios

9.9.3.4 The following scenarios were modelled:

- Without Hornsea Three Construction Traffic – without the construction traffic associated with Hornsea Three during the first year that the construction is expected to occur, 2022; and
- With Hornsea Three Construction Traffic – with the construction traffic associated with Hornsea Three during the first year that the construction is expected to occur, 2022.

Model Input Data

Traffic Flow Data

9.9.3.5 Traffic data used in the assessment have been provided by the Hornsea Three's transport consultants, RPS. Baseline traffic surveys have been completed and subsequently used to predict the changes in traffic levels during construction and are summarised in volume 6, annex 7.3: Baseline Traffic Flows and 7.7: Traffic Flows with Construction Traffic respectively. That information has been used in this chapter to assess emissions from construction traffic. The road links chosen represent all roads on which there is anticipated to be a significant change in traffic up to 500 m from the site boundary.

9.9.3.6 The traffic flow data provided for this assessment are summarised in Table 9.24. The modelled road links are illustrated in Figure 9.2.

Table 9.24: Traffic data used within the assessment.

Road Link ID	Access Route Name	Speed Limit (km.hr-1)	Daily Two-Way Vehicle Flow			
			Without Hornsea Three		With Hornsea Three	
			LDV	HDV	LDV	HDV
1	A148, west of The Street and east of Green Lane	96	12541	1367	12681	1593
2	A148 west of Holt and east of Letheringsett	96	10346	1121	10485	1347
3	A148, east of the B1149 roundabout and west of Station Road	64	11095	1148	11178	1326
4	B1354 between the Swanton Road junction and B1110 junctions	96	3550	487	3550	487
5	B1354 east of Melton Constable and west of Briston	48	4926	673	4926	673
6	B1149 at Edgefield, north of the village hall and south of Hempstead Road	64	4192	345	4329	569
7	A148 at High Kelling, south of Kelling Hospital	64	12731	1162	12815	1340
8	A148, east of Bodham and west of the Woodlands Leisure centre	96	12103	1134	12347	1340
9	A148, west of the B1436 junction and east of the Lion's Mouth junction	80	13139	1207	13461	1425
10	B1436, east of Felbrigg	48	8861	804	9184	1022
11	A140, south of Roughton and north of the Topshill Road junction	64	11124	917	11446	1135
12	A149 west of Weybourne and east of The Pheasant Hotel	48	3336	231	3336	231
13	A149 east of Weybourne, west of the North Norfolk Railway Line	96	4506	265	4639	376
14	A1067, north of Bridge Road and east of Little Ryburgh	96	8362	1089	8434	1217
15	B1145 at Bawdeswell, between The Street junction and Hall Road junction	48	3073	317	3073	317

Road Link ID	Access Route Name	Speed Limit (km.hr-1)	Daily Two-Way Vehicle Flow			
			Without Hornsea Three		With Hornsea Three	
			LDV	HDV	LDV	HDV
16	B1145, west of Reepham and east of the Old Lane junction	96	2657	323	2657	323
17	B1145 east of Cawston, west of the B1149 crossroads	96	3257	220	3500	409
18	B1145 east of the B1149 crossroads junction, west of Cawston Park Hospital	96	4477	358	4558	358
19	A140, south of Aylsham's B1145 / A140 roundabout, and north of Marsham	96	14321	1411	14604	1628
20	A1067, between Attlebridge and the Fir Covert Road junction	96	8221	774	8496	930
21	A140 between the A47 and B1113 junctions	96	22564	2304	22881	2568
22	B1113, south of the A47 near Norwich Sports ground	96	8239	609	8557	873
23	A47 at Honingham (Highways England)	96	27016	2928	27177	3175
24	A47 at Bawburgh (Highways England)	113	44708	3435	44883	3682
25	A47 at Intwood (Highways England)	113	53483	4520	53900	4794
26	A11 at Hethersett (Highways England)	113	49130	4522	49258	4720
27	A47, between A140 and A146 junctions	113	50796	4293	51208	4522
28	A1065, North of Swaffham	96	7805	530	7899	709
29	A1065, east of Weasenham	80	5032	548	5126	727
30	A1082, South of Sheringham	48	8668	119	8801	230
31	A1270 Northern Distributor Road between A1067 and B1149 junction	113	20099	1368	20315	1525
32	B1149 between A1270 Northern Distributor Road and Buxton Road junctions	96	10806	594	11222	841
33	A1270 Northern Distributor Road between B1149 and A140 junctions	113	23407	1593	24014	1945
34	A1270 Northern Distributor Road between A140 and A47 junctions	113	21472	1461	21937	1738
35	A140 between A1270 and B1145	96	14482	484	14765	702
36	A1270 between A140 and A47 (Near junction with A47)	113	33113	2254	33578	2530
37	A47 East of A1270 junction	113	42351	2882	42752	2935

Notes: (km.hr^{-1}) = kilometres per hour

9.9.3.7 The average speed on each road has been reduced by 6.2 mph (10 km.hr^{-1}) to take into account the possibility of slow moving traffic near junctions and at roundabouts in accordance with LAQM.TG16.

Vehicle Emission Factors

9.9.3.8 The modelling has been undertaken using Defra's 2017 emission factor toolkit (version 8.0) which draws on emissions generated by the European Environment Agency (EEA) COPERT 5 emission calculation tool.

Meteorological Data

9.9.3.9 The ADMS-Roads model requires detailed meteorological data as an input. The most representative observing station for the region of the Hornsea Three air quality (traffic emissions) study area that supplies all the data in the required format is at Wattisham approximately 50 km south of the Hornsea Three site. Meteorological data from that station for 2015 (the most recently updated data) has been used within the dispersion model. The wind rose is presented in Figure 9.5.

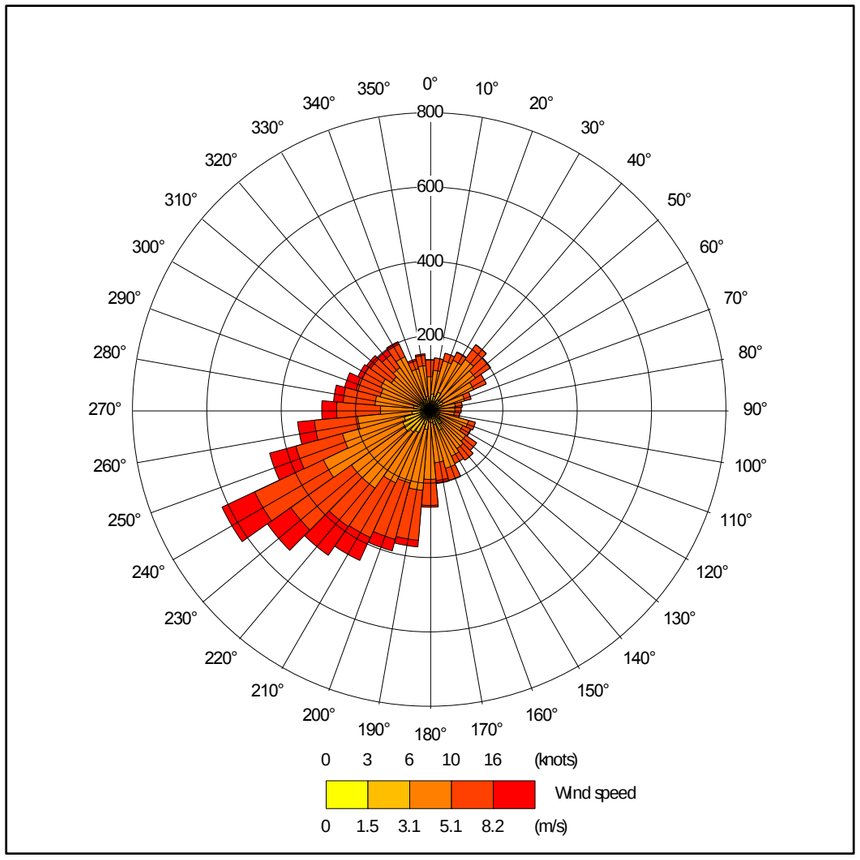


Figure 9.5: Wind Rose: Wattisham (2015).

Receptors

9.9.3.10 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. For assessing human-health impacts, such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG16 provides examples of exposure locations and these are summarised in Table 9.25.

Table 9.25: Examples of where air quality objectives 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 façades of residential properties, schools, hospitals, care homes.	Building façades 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's façades), or any other location where public exposure is expected to be short-term.
Daily-mean	All locations where the annual-mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building's façade), or any other location where public exposure is expected to be short-term.
Hourly-mean	All locations where the annual and 24 hour mean would apply. Kerbside sites (e.g. 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 to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access

9.9.3.11 Representative sensitive receptors for this assessment have been selected at properties where pollutant concentrations and/or changes in pollutant concentrations are anticipated to be greatest, as listed in Table 9.26 and shown in Figure 9.2.

Table 9.26: Modelled sensitive receptors.

ID	Description	Easting	Northing
1	Aylsham (B1145)	619485	325736
2	Cawston (B1145)	613498	323901
3	Chestnut House (A1270)	615956	315826
4	Horsford (B1149)	619050	316620
5	Marsham (A140)	619732	323977
6	Morton (A1067)	612369	317019
7	New Holme Farm (B1149)	620269	314438
8	Newton St Faith (A140)	621747	316987
9	Aylmerton (A148)	618399	340587
10	Bodham (A148)	612579	340144
11	Edgefield (B1149)	609738	334526
12	Fakenham 1 (A148)	591426	330957
13	Felbrigg (B1436)	620721	339628
14	High Kelling (A148)	610049	339765
15	Holt 1 (A148)	607708	338638
16	Holt 2 (B1149)	607848	338110
17	Kelling (A149)	610192	342776
18	Roughton (B1436)	621918	337020
19	Sheringham 1 (A149)	615726	342970
20	Sheringham 2 (A1082)	615458	341869
21	Weybourne (A149)	611162	342989
22	Dereham (A47)	598970	312158
23	Necton (A47)	587750	310152
24	Tumbler Hill, Swaffam (A47)	582336	309908
25	Weasingham All Saints (A1065)	585059	321399
26	Grange Bungalow (A47)	629655	308673
27	Heath Farm (A1270)	629120	308840
28	Hempton (A1065)	591221	329226
29	Dunston Cottages (A140)	621954	304886
30	Intwood (A47)	619707	304361
31	Mulbarton (B1113)	618981	300728
32	Station Farm (A11)	616870	304223
33	Swardeston (B1113)	620077	302430
34	Twins Farm (A47)	623584	305314
35	Vine Cottage (A47)	616515	307659
36	Bawdeswell (B1145)	604780	320902
37	Guist (A1067)	599789	325578
38	Reepham (B1145)	609764	322891
39	Barney (B1354)	599516	333569
40	Briston (B1354)	606654	333003
41	Fakenham 2 (A1067)	593733	330177
42	Melton Constable (B1354)	604307	333090

9.9.3.12 The annual, daily and hourly-mean AQS objectives apply at the front and rear façades of all residential properties. The approaches used to predict the concentrations for these different averaging periods are described below.

Long-Term Pollutant Predictions

9.9.3.13 Annual-mean NO_x and PM_{10} concentrations have been predicted at selected sensitive receptors using ADMS-Roads, then added to relevant background concentrations. Primary NO in the NO_x emissions is converted to NO_2 to a degree determined by the availability of atmospheric oxidants locally and the strength of sunlight. For road traffic sources, annual-mean NO_2 concentrations have been derived from the modelled road-related annual-mean NO_x concentration generated using Defra's NO_x to NO_2 calculator tool (Defra, 2017).

Short-Term Pollutant Predictions

9.9.3.14 In order to predict the likelihood of exceedences of the hourly-mean AQS objectives for NO_2 and the daily-mean AQS objective for PM_{10}, the following relationships between the short-term and the annual-mean values at each receptor have been considered.

Hourly-Mean AQS Objective for NO_2

9.9.3.15 Research undertaken in support of LAQM.TG16 has indicated that the hourly-mean limit value and objective for NO_2 is unlikely to be exceeded at a roadside location where the annual-mean NO_2 concentration is less than 60 µg.m^{-3}. The threshold of 60 µg.m^{-3} NO_2 has been used as the guideline for considering a likely exceedence of the hourly-mean nitrogen dioxide objective."

Daily-Mean AQS Objective for PM_{10}

9.9.3.16 The number of exceedences of the daily-mean AQS objective for PM_{10} of 50 µg.m^{-3} may be estimated using the relationship set out in LAQM.TG16:

*Number of Exceedences of Daily Mean of 50 µg.m^{-3} = -18.5 + 0.00145 * (Predicted Annual-mean PM_{10})^3 + 206 / (Predicted Annual-mean PM_{10} Concentration)*

9.9.3.17 This relationship indicates that the daily-mean AQS objective for PM_{10} is likely to be met if the predicted annual-mean PM_{10} concentration is 31.8 µg.m^{-3} or less. The daily mean objective is not therefore considered further within this assessment if the annual-mean PM_{10} concentration is predicted to be less than 31.5 µg.m^{-3}.

Significance Criteria for Development Impacts on the Local Area

9.9.3.18 The EPUK & IAQM Land-Use Planning & Development Control: Planning for Air Quality document advises that:

9.9.3.19 *"The significance of the effects arising from the impacts on air quality will depend on a number of factors and will need to be considered alongside the benefits of the development in question. Development under current planning policy is required to be sustainable and the definition of this includes social and economic dimensions, as well as environmental. Development brings opportunities for reducing emissions at a wider level through the use of more efficient technologies and better designed buildings, which could well displace emissions elsewhere, even if they increase at the development site. Conversely, development can also have adverse consequences for air quality at a wider level through its effects on trip generation."*

9.9.3.20 When describing the air quality impact at a sensitive receptor, the change in magnitude of the concentration should be considered in the context of the absolute concentration at the sensitive receptor. Table 9.27 provides the EPUK & IAQM approach for describing the long-term air quality impacts at sensitive human-health receptors in the surrounding area.

Table 9.27: Impact Descriptors for Individual Sensitive Receptors.

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
75 % or less of AQAL	Negligible	Negligible	Slight	Moderate
76 -94 % of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102 % of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109 % of AQAL	Moderate	Moderate	Substantial	Substantial
110 % or more than AQAL	Moderate	Substantial	Substantial	Substantial

[1] AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'

[2]. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as negligible.

3. The table is only designed to be used with annual mean concentrations.

4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.

6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

[7]. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

9.9.3.21 The human-health impact descriptors above apply at individual receptors. The EPUK & IAQM guidance states that the impact descriptors "*are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it maybe that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.*"

9.9.3.22 Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts. This judgement is likely to take into account the extent of the current and future population exposure to the impacts and the influence and/or validity of any assumptions adopted during the assessment process.

Uncertainty

9.9.3.23 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

9.9.3.24 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

9.9.3.25 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the uncertainty range informed by an analysis of relevant, available data.

9.9.3.26 The atmospheric dispersion model used for this assessment, ADMS Roads, has been validated by its supplier and is widely used by professionals in the UK and overseas. A site-specific verification (calibration) provides additional certainty and is particularly important when air quality levels are close to exceeding the objectives/limit values.

9.9.3.27 LAQM.TG16 requires that local authorities verify the results of any detailed modelling undertaken for the purposes of fulfilling their R&A duties. Model verification refers to the checks that are carried out on model performance at a local level. Modelled concentrations are compared with the results of monitoring. Where there is a disparity between modelled and monitored concentrations, the first step is to review the appropriateness of the data inputs to determine whether the performance of the model can be improved. Once reasonable efforts have been made to reduce the uncertainties in the data inputs, an adjustment may be established and applied to reduce any remaining disparity between modelled and monitored concentrations. No adjustment factor is deemed necessary where the modelled concentrations are within 25% of the monitored concentrations.

9.9.3.28 For the verification and adjustment of NO_x/NO_2 concentrations for local authorities in their own Review and Assessment (R&A) duties, it is recommended that the comparison involves a combination of automatic and diffusion monitoring, rather than a single automatic monitor. This is to ensure any adjustment factor derived is representative of all locations modelled and not unduly weighted towards the characteristics at a single site. Where only diffusion tubes are used for the model verification, the study should consider a broad spread of monitoring locations across the Hornsea Three air quality (traffic emissions) study area to provide sufficient information relating to the spatial variation in pollutant concentrations.

9.9.3.29 Local Authorities generally implement a broad spread of monitoring, particularly in areas that are known to be sensitive to changes in air quality. Consequently, Local Authorities are usually able to verify the models they use for R&A purposes; however, for individual developments, there is less likely to be a broad range of monitoring locations within the relevant study area. In this case, a broad spread of monitoring data is not currently available to allow the model to be verified for the Hornsea Three air quality (traffic emissions) study area. In line with the LAQM.TG(16) guidance, a maximum adjustment factor of 4 has been applied to the results of the modelling as a sensitivity check to determine if the impacts remain 'not significant'.

9.9.3.30 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 9.28.

Table 9.28: Approaches to dealing with uncertainty used within the assessment.

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of current baseline air quality conditions	The background concentration used within the assessment is a realistic rural value from a comparison of measured and Defra mapped concentration estimate.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within the model contributes to the result being towards the top of the uncertainty range, rather than a central estimate.
	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the development does not proceed)	The future background concentration used in the assessment is the same as the 2015 background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	
Fraction from Modelled Sources	Traffic flow estimates	Traffic flows provided have all been based on traffic counts, rather than flows derived from a traffic model. High growth assumptions have been used to develop the traffic dataset used within the model.	The modelled fraction is a minor proportion of the total predicted concentration. The modelled fraction is likely to contributes to the result being

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
	Traffic speed estimates	Maximum speed limits have been used within the model. The average speed has been reduced in congested areas to take account of slow-moving and queuing traffic.	towards between a central estimate and the top of the uncertainty range.
	Road-related emission factors – projection to future years	The most recently published emission factors have been used within the modelling and these are based on the current and best understanding of the variation in emission factors in future years.	
	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for a full year of meteorological conditions. This means that the conditions in 8,760 hours have been considered in the assessment.	
	Receptors	Receptor locations have been identified where concentrations are highest or where the greatest changes are expected.	
	Dispersion Modelling	In line with the LAQM.TG(16) guidance, a maximum adjustment factor of 4 has been applied to the results of the modelling as a sensitivity check. The impacts remain 'not significant' with this adjustment factor applied and these adjusted results have been used for the final results of this assessment.	

9.9.3.31 The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when Hornsea Three is being constructed/ decommissioned are unlikely to be higher than those presented within this report and are more likely to be lower. The assessment presented within this chapter is therefore considered to be the maximum design scenario.

9.10 Measures adopted as part of Hornsea Three

9.10.1.1 As part of the project design process, several designed-in measures have been proposed to reduce the potential for air quality impacts (see Table 9.29). As there is a commitment to implementing these measures, they are considered inherently part of the design of Hornsea Three and have therefore been considered in the assessment presented in section 9.11 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development. These measures will be implemented under the Outline CoCP (document reference A8.5).

9.10.1.2 The IAQM dust guidance lists control measures for low, medium and high dust risks which would be adopted for Hornsea Three where possible.

Table 9.29: Designed-in dust control measures adopted as part of Hornsea Three.

Measures adopted as part of Hornsea Three	Justification
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site. Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager. Display the head or regional office contact information.	To facilitate community engagement and a proactive approach to complaints regarding nuisance dusts.
Develop and implement a Dust Management and Monitoring Plan (DMMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the 'highly-recommended' measures in the IAQM guidance. The 'desirable' measures should be included as appropriate for the site. The DMMP may also include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.	To document controls to prevent or control the generation and release of nuisance dusts during construction.
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. Make the complaints log available to the local authority when asked. Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book. Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.	To facilitate community engagement and a proactive approach to complaints regarding nuisance dusts.

Measures adopted as part of Hornsea Three	Justification
Visual Checks: Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary. Carry out regular site inspections to monitor compliance with the DMMP, record inspection results, and make an inspection log available to the local authority when asked. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. Quantitative Monitoring: Agree key locations for dust deposition, dust flux, or real-time PM_{10} continuous monitoring with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	To verify the effective control of dust releases at the site.
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site. Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period. Avoid site runoff of water or mud. Keep site fencing, barriers and scaffolding clean using wet methods. Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below. Cover, seed or fence stockpiles to prevent wind whipping.	To minimise generation of nuisance dusts during construction.
Ensure all vehicles switch off engines when stationary – no idling vehicles. Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable. Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate). Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials. Implement a Construction Traffic Management Plan to ensure the efficient movement of traffic during the construction and decommissioning phase of Hornsea Three. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	To minimise generation of nuisance dusts during construction.
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction (e.g. suitable local exhaust ventilation systems). Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. Use enclosed chutes and conveyors and covered skips. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate. Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	To minimise generation of nuisance dusts during construction.
Avoid bonfires and burning of waste materials.	To minimise generation of nuisance dusts during construction.
Soft-strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust). Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground. Avoid explosive blasting, using appropriate manual or mechanical alternatives. Bag and remove any biological debris or damp down such material before demolition.	To minimise generation of nuisance dusts during demolition
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. Where practicable, only remove the cover in small areas during work and not all at once.	To minimise generation of nuisance dusts during construction.
Avoid scabbling (roughening of concrete surfaces) if possible. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	To minimise generation of nuisance dusts during construction.

Measures adopted as part of Hornsea Three	Justification
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. Avoid dry sweeping of large areas. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. Record all inspections of haul routes and any subsequent action in a site log book. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits. Access gates to be located at least 10 m from receptors where possible.	To minimise generation of nuisance dusts during construction.

9.11 Assessment of significance

9.11.1 Construction phase

9.11.1.1 The impacts on air quality of the onshore construction of Hornsea Three have been assessed and are listed in Table 9.10 along with the maximum design scenario against which each construction phase impact has been assessed.

9.11.1.2 A description of the significance of effects upon air quality receptors caused by each identified impact is given below.

Temporary impacts during the construction of Hornsea Three that may affect receptors sensitive to dust (human and ecological).

Magnitude of impact

9.11.1.3 The area containing the onshore elements of Hornsea Three as well as the compounds, storage areas and access corridors is in excess of 10,000 m^2 and the dust emission magnitude for the earthworks phase is therefore classified as large.

9.11.1.4 Construction work is to be conducted at the Hornsea Three onshore HVAC booster station and HVDC converter/HVAC substation (Figure 9.1), The total volume of the buildings to be constructed is expected to be between 25,000 and 100,000 m^3. Using the IAQM guidance, the dust emission magnitude for the areas of construction is classified as medium. In accordance with the guidance, and following a precautionary approach, the dust emission magnitude for construction for the remainder of the Hornsea Three construction dust study area (outside of the HVAC booster station and HVDC converter/HVAC substation sites) is classified as small.

9.11.1.5 In lieu of appropriate information, the maximum design scenario has been adopted (Table 9.10). The maximum number of outwards movements in any one day is in excess of 50 HDVs, and the dust emission magnitude for track-out is classified as large (Table 9.30).

9.11.1.6 Table 9.30 shows the magnitude of dust impact during the construction phase of Hornsea Three as worst-case without any mitigation or dust-control measures, as required by the IAQM Guidance. Nevertheless, the significance of effect described in the following section assumes that the design measures committed to in Table 9.29 have been adopted, reducing the significance compared to if no measures were adopted.

Table 9.30: Dust Emission Magnitude for earthworks, construction and trackout during the construction phase of Hornsea Three.

Earthworks	Construction	Trackout
Large	Medium	Large

Pathway and Receptor - Sensitivity of the area

9.11.1.7 All earthworks and construction activities are assumed to occur within the boundary of the onshore elements of Hornsea Three and the compounds, storage areas and access corridors. As such, receptors at distances within 20 m, 50 m, 100 m, 200 m and 350 m of the site boundary, as described in the IAQM guidance, have been identified. The IAQM methodology requires that the collective sensitivity of the surrounding area to demolition, construction and earthworks, is categorised. This has been carried out and is shown in Table 9.31.

Table 9.31: Sensitivity of the surrounding area for earthworks and construction.

Potential impact	Sensitivity of the surrounding area	Reason for sensitivity classification
Potential impact of dust soiling	High	There are between 10 and 100 high-sensitivity receptors within 20 m of the onshore elements of Hornsea Three.
Potential impact on human health	Low	There are between 10 and 100 high-sensitivity receptors within 20 m of the onshore elements of Hornsea Three and existing PM_{10} concentrations are between 16 and 18 $\mu g.m^{-3}$.
Potential impact on ecological receptors	High	There are five designated ecological sites within the Hornsea Three air quality (construction dust) study area: • Kelling Heath SSSI; • Edgfield Little Wood SSSI; • Booton Common SSSI and SAC; • Alderford Common SSSI; and • River Wensum Designated sites, and other habitats by airborne pollutants are assessed in chapter 3: Ecology and Nature Conservation.

9.11.1.8 The IAQM advises that trackout may occur on roads up to 500 m from the boundary of the onshore elements of Hornsea Three and the compounds, storage areas, access corridors and the main compound, which covers an extensive area. The sensitivity of the area potentially impacted by trackout, which is defined as within 50 m of the edges of these roads, is summarised in Table 9.32.

Table 9.32: Sensitivity of the surrounding area for trackout.

Potential impact	Sensitivity of the surrounding area	Reason for sensitivity classification
Potential impact of dust soiling	High	There are more than 100 high-sensitivity receptors within 50 m of the edge of roads within 500 m of the onshore elements of Hornsea Three.
Potential impact on human health	Low	There are more than 100 high sensitivity receptors within 50 m of the edge of roads within 500 m of the order limits and existing PM_{10} concentrations are between 16 and 18 $\mu g.m^{-3}$.
Potential impact on ecological receptors	High	There are five designated ecological sites within the Hornsea Three air quality (construction dust) study area; • Kelling Heath SSSI; • Edgfield Little Wood SSSI; • Booton Common SSSI and SAC; • Alderford Common SSSI; and • River Wensum. Designated sites, and other habitats by airborne pollutants are assessed in chapter 3: Ecology and Nature Conservation.

Significance of effect

9.11.1.9 The Dust Emission Magnitude has been considered in the context of the Sensitivity of the Area to give the Risk of Dust Impacts. Table 9.33 summarises the risk of dust impacts associated with the construction phase of Hornsea Three for the four activities.

Table 9.33: Risk of Dust Impacts for earthworks, construction and trackout during the construction phase of Hornsea Three.

Potential impact	Source					
	Earthworks		Construction		Trackout	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Potential impact of dust soiling	High	Negligible	Medium	Negligible	High	Negligible
Potential impact on human health	Low	Negligible	Low	Negligible	Low	Negligible
Potential impact on ecological receptors	High	Negligible	Medium	Negligible	High	Negligible
Risk	**High**	**Negligible**	**Medium**	**Negligible**	**High**	**Negligible**

9.11.1.10 In the absence of dust controls, the overall dust impact risk for construction is categorised as medium, and the dust impact risk for earthworks and track-out is categorised as high, based on the dust emission magnitudes shown below and the receptor sensitivities in the area. Taking the site as a whole, the risk has been categorised as high in the absence of dust controls.

9.11.1.11 The dust control measures appropriate to a level of risk for the Hornsea Three air quality (construction dust) site area and for each of the phases are set out in Table 9.29.

9.11.1.12 The IAQM guidance states that "*For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'*." (IAQM, 2014, page 28). The IAQM dust guidance recommends that significance is only assigned to the effect after the activities are considered with controls and mitigation in place.

9.11.1.13 The impact, which would affect receptors directly, is considered to be potentially high in the absence of dust controls; however, with the application of controls recommended for high risk, the risk of impacts would be expected to be reduced such that the effect is not significant. Furthermore, the impact is predicted to be of local spatial extent, intermittent and effects are not anticipated to continue beyond the construction phase (i.e. they are predominantly reversible).

9.11.1.14 The effect with the IAQM recommended dust controls in place will, therefore, be **not significant** in EIA terms.

9.11.1.15 For further assessment of ecological impacts see chapter 3: Ecology and Nature Conservation.

Temporary impacts due to construction traffic which may affect human and ecological receptors

9.11.1.16 This section of the report summarises the air quality impacts of the key pollutants associated with the construction traffic during the construction and decommissioning phases of Hornsea Three.

Nitrogen Dioxide (NO_2)

9.11.1.17 Table 9.34 presents the annual-mean NO_2 concentrations predicted at the façades of existing receptors. presents the annual-mean NO_2 concentrations predicted at the façades of existing receptors.

Table 9.34: Predicted Annual Mean NO_2 impacts at existing receptors.

Receptor ID	Receptor Description	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
		Without Hornsea Three	With Hornsea Three		
1	Aylsham (B1145)	11.1	11.1	0	Negligible
2	Cawston (B1145)	10.9	11.1	1	Negligible
3	Chestnut House (A1270)	14.7	14.8	0	Negligible
4	Horsford (B1149)	16.6	17.0	1	Negligible
5	Marsham (A140)	15.6	15.8	1	Negligible
6	Morton (A1067)	14.5	14.8	1	Negligible
7	New Holme Farm (B1149)	17.8	18.1	1	Negligible
8	Newton St Faith (A140)	13.2	13.4	0	Negligible
9	Aylmerton (A148)	14.6	14.8	1	Negligible
10	Bodham (A148)	15.7	15.9	1	Negligible
11	Edgefield (B1149)	12.1	12.5	1	Negligible
12	Fakenham 1 (A148)	13.5	13.6	0	Negligible

Receptor ID	Receptor Description	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
		Without Hornsea Three	With Hornsea Three		
13	Felbrigg (B1436)	16.3	16.9	1	Negligible
14	High Kelling (A148)	17.2	17.5	1	Negligible
15	Holt 1 (A148)	17.9	18.2	1	Negligible
16	Holt 2 (B1149)	11.2	11.4	1	Negligible
17	Kelling (A149)	10.1	10.1	0	Negligible
18	Roughton (B1436)	14.3	14.7	1	Negligible
19	Sheringham 1 (A149)	12.5	12.7	0	Negligible
20	Sheringham 2 (A1082)	15.3	15.6	1	Negligible
21	Weybourne (A149)	11.4	11.5	0	Negligible
22	Dereham (A47)	21.5	21.6	0	Negligible
23	Necton (A47)	23.4	23.6	0	Negligible
24	Tumbler Hill, Swaffam (A47)	10.8	10.8	0	Negligible
25	Weasingham All Saints (A1065)	12.6	12.7	0	Negligible
26	Grange Bungalow (A47)	15.1	15.1	0	Negligible
27	Heath Farm (A1270)	14.0	14.1	0	Negligible
28	Hempton (A1065)	11.4	11.5	0	Negligible
29	Dunston Cottages (A140)	27.6	28.0	1	Negligible
30	Intwood (A47)	15.9	16.0	0	Negligible
31	Mulbarton (B1113)	15.1	15.5	1	Negligible
32	Station Farm (A11)	19.6	19.6	0	Negligible
33	Swardeston (B1113)	15.3	15.7	1	Negligible
34	Twins Farm (A47)	14.2	14.2	0	Negligible
35	Vine Cottage (A47)	14.3	14.3	0	Negligible
36	Bawdeswell (B1145)	11.1	11.1	0	Negligible
37	Guist (A1067)	12.9	12.9	0	Negligible
38	Reepham (B1145)	11.3	11.3	0	Negligible
39	Barney (B1354)	12.4	12.5	0	Negligible
40	Briston (B1354)	13.8	13.8	0	Negligible
41	Fakenham 2 (A1067)	13.7	13.8	0	Negligible
42	Melton Constable (B1354)	12.1	12.1	0	Negligible
Maximum		**27.6**	**28.0**	**1**	**-**
Minimum		**10.1**	**10.1**	**0**	**-**

9.11.1.18 Predicted annual-mean NO_2 concentrations in the first year of construction of Hornsea Three at the façades of the existing receptors are below the AQS objective for NO_2. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is 'negligible'.

9.11.1.19 As all predicted annual-mean NO_2 concentrations are below 60 µg.m^{-3}, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

9.11.1.20 Overall, the impact on the surrounding area from NO_2 is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Particulate Matter (PM_{10})

9.11.1.21 Table 9.35 presents the annual-mean PM_{10} concentrations predicted at the façades of existing receptors.

Table 9.35: Predicted Annual-Mean PM_{10} Impacts at Existing Receptors.

Receptor ID	Receptor Description	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
		Without Hornsea Three	With Hornsea Three		
1	Aylsham (B1145)	14.4	14.4	0	Negligible
2	Cawston (B1145)	14.4	14.5	0	Negligible
3	Chestnut House (A1270)	14.7	14.7	0	Negligible
4	Horsford (B1149)	15.4	15.5	0	Negligible
5	Marsham (A140)	15.2	15.2	0	Negligible
6	Morton (A1067)	15.1	15.2	0	Negligible
7	New Holme Farm (B1149)	15.3	15.4	0	Negligible
8	Newton St Faith (A140)	14.7	14.8	0	Negligible
9	Aylmerton (A148)	15.2	15.3	0	Negligible
10	Bodham (A148)	15.4	15.4	0	Negligible
11	Edgefield (B1149)	14.7	14.8	0	Negligible
12	Fakenham 1 (A148)	14.9	15.0	0	Negligible
13	Felbrigg (B1436)	15.4	15.6	0	Negligible
14	High Kelling (A148)	15.7	15.7	0	Negligible
15	Holt 1 (A148)	15.8	16.0	0	Negligible
16	Holt 2 (B1149)	14.5	14.5	0	Negligible
17	Kelling (A149)	14.3	14.3	0	Negligible
18	Roughton (B1436)	15.0	15.1	0	Negligible
19	Sheringham 1 (A149)	14.7	14.7	0	Negligible
20	Sheringham 2 (A1082)	15.0	15.1	0	Negligible
21	Weybourne (A149)	14.5	14.5	0	Negligible
22	Dereham (A47)	16.5	16.5	0	Negligible
23	Necton (A47)	16.9	17.0	0	Negligible
24	Tumbler Hill, Swaffam (A47)	14.4	14.4	0	Negligible
25	Weasingham All Saints (A1065)	14.7	14.8	0	Negligible
26	Grange Bungalow (A47)	14.7	14.7	0	Negligible
27	Heath Farm (A1270)	14.6	14.6	0	Negligible
28	Hempton (A1065)	14.6	14.6	0	Negligible
29	Dunston Cottages (A140)	17.6	17.8	0	Negligible
30	Intwood (A47)	14.8	14.8	0	Negligible
31	Mulbarton (B1113)	15.2	15.3	0	Negligible
32	Station Farm (A11)	15.3	15.3	0	Negligible
33	Swardeston (B1113)	15.2	15.3	0	Negligible
34	Twins Farm	14.6	14.6	0	Negligible

Receptor ID	Receptor Description	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
		Without Hornsea Three	With Hornsea Three		
	(A47)				
35	Vine Cottage (A47)	14.6	14.6	0	Negligible
36	Bawdeswell (B1145)	14.4	14.4	0	Negligible
37	Guist (A1067)	14.9	14.9	0	Negligible
38	Reepham (B1145)	14.5	14.5	0	Negligible
39	Barney (B1354)	14.7	14.8	0	Negligible
40	Briston (B1354)	14.9	14.9	0	Negligible
41	Fakenham 2 (A1067)	15.0	15.0	0	Negligible
42	Melton Constable (B1354)	14.6	14.6	0	Negligible
Maximum		**17.6**	**17.8**	**0**	-
Minimum		**14.3**	**14.3**	**0**	-

9.11.1.22 Predicted annual-mean PM_{10} concentrations in the first year of construction at Hornsea Three at the façades of the existing receptors are well below the AQS objective for PM_{10}. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is categorised as 'negligible' at all receptors.

9.11.1.23 As all predicted annual mean PM_{10} concentrations are below 31.5 µg.m^{-3}, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

9.11.1.24 Overall, the impact on the surrounding area from PM_{10} is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Fine Particulate Matter ($PM_{2.5}$)

9.11.1.25 Table 9.36 presents the annual-mean $PM_{2.5}$ concentrations predicted at the façades of existing receptors.

Table 9.36: Predicted Annual-Mean $PM_{2.5}$ Impacts at Existing Receptors.

Receptor ID	Receptor Description	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
		Without Hornsea Three	With Hornsea Three		
1	Aylsham (B1145)	9.5	9.5	0	Negligible
2	Cawston (B1145)	9.4	9.5	0	Negligible
3	Chestnut House (A1270)	9.6	9.7	0	Negligible
4	Horsford (B1149)	10.0	10.1	0	Negligible
5	Marsham (A140)	9.9	9.9	0	Negligible
6	Morton (A1067)	9.9	9.9	0	Negligible
7	New Holme Farm (B1149)	10.0	10.0	0	Negligible
8	Newton St Faith (A140)	9.6	9.7	0	Negligible
9	Aylmerton (A148)	9.9	9.9	0	Negligible
10	Bodham (A148)	10.0	10.0	0	Negligible
11	Edgefield (B1149)	9.6	9.6	0	Negligible
12	Fakenham 1 (A148)	9.7	9.8	0	Negligible
13	Felbrigg (B1436)	10.0	10.1	0	Negligible
14	High Kelling (A148)	10.2	10.2	0	Negligible
15	Holt 1 (A148)	10.3	10.3	0	Negligible
16	Holt 2 (B1149)	9.5	9.5	0	Negligible
17	Kelling (A149)	9.4	9.4	0	Negligible
18	Roughton (B1436)	9.8	9.8	0	Negligible

Receptor ID	Receptor Description	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
		Without Hornsea Three	With Hornsea Three		
19	Sheringham 1 (A149)	9.6	9.6	0	Negligible
20	Sheringham 2 (A1082)	9.8	9.9	0	Negligible
21	Weybourne (A149)	9.5	9.5	0	Negligible
22	Dereham (A47)	10.6	10.7	0	Negligible
23	Necton (A47)	10.9	10.9	0	Negligible
24	Tumbler Hill, Swaffam (A47)	9.4	9.4	0	Negligible
25	Weasingham All Saints (A1065)	9.6	9.7	0	Negligible
26	Grange Bungalow (A47)	9.6	9.6	0	Negligible
27	Heath Farm (A1270)	9.6	9.6	0	Negligible
28	Hempton (A1065)	9.5	9.6	0	Negligible
29	Dunston Cottages (A140)	11.3	11.4	0	Negligible
30	Intwood (A47)	9.7	9.7	0	Negligible
31	Mulbarton (B1113)	9.9	10.0	0	Negligible
32	Station Farm (A11)	10.0	10.0	0	Negligible
33	Swardeston (B1113)	9.9	10.0	0	Negligible
34	Twins Farm (A47)	9.6	9.6	0	Negligible
35	Vine Cottage (A47)	9.6	9.6	0	Negligible
36	Bawdeswell (B1145)	9.5	9.5	0	Negligible
37	Guist (A1067)	9.7	9.7	0	Negligible
38	Reepham (B1145)	9.5	9.5	0	Negligible
39	Barney (B1354)	9.6	9.6	0	Negligible
40	Briston (B1354)	9.7	9.7	0	Negligible
41	Fakenham 2 (A1067)	9.8	9.8	0	Negligible
42	Melton Constable (B1354)	9.6	9.6	0	Negligible
Maximum		**11.3**	**11.4**	**0**	-
Minimum		**9.4**	**9.4**	**0**	-
AQS objective = 25 µg.m^{-3}					

9.11.1.26 Predicted annual-mean $PM_{2.5}$ concentrations in the first year of construction at Hornsea Three at the façades of the existing receptors are below the AQS objective for $PM_{2.5}$ at all receptors. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is categorised as 'negligible' at all receptors.

9.11.1.27 Overall, the impact on the surrounding area from $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Future monitoring

9.11.1.28 With the exception of dust monitoring set out in Table 9.29 and the outline CoCP (document reference A8.5), no other monitoring is considered necessary to test the predictions made within the construction phase impact assessment.

9.11.2 Operation and maintenance phase

9.11.2.1 As outlined in section 9.8.2, potential operational and maintenance impacts on air quality have been scoped out of this assessment.

9.11.3 Decommissioning phase

9.11.3.1 The impacts on air quality of the onshore decommissioning of Hornsea Three have been assessed and are listed in Table 9.10 along with the maximum design scenario against which each decommissioning phase impact has been assessed (Table 9.10).

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

Temporary impacts of decommissioning of Hornsea Three that may affect receptors sensitive to dust (human and ecological).

9.11.3.3 The temporary impacts of decommissioning of Hornsea Three may affect receptors sensitive to dust (human and ecological).

9.11.3.4 A description of the significance of effects upon air quality receptors caused by each identified impact is given below.

Magnitude of dust impact

9.11.3.5 The magnitude of dust impacts of decommissioning activities associated with earthworks and trackout are expected to be the same or similar to the impacts from construction at the onshore HVAC booster station and HVDC converter/HVAC substation as assessed in section 9.11.1. It is anticipated that the cable corridor will be left in situ with minimal decommissioning works. As such, the magnitude of impacts from decommissioning the Hornsea Three onshore cable corridor is expected to be less than the impacts from construction.

9.11.3.6 During the decommissioning phase, the Hornsea Three onshore HVAC booster station and HVDC converter/HVAC substation will be demolished. The total volume of the buildings to be demolished is expected to be between 25,000 and 100,000 m^3. Using the IAQM guidance, the dust emission magnitude for the areas of demolition is classified as medium. In accordance with the guidance, and following a precautionary approach, outside of the booster station and substation sites the dust emission magnitude for demolition is classified as small. No additional construction work is anticipated during the decommissioning phase. In accordance with the guidance, and following a precautionary approach, the dust emission magnitude for construction is classified as small.

9.11.3.7 The impact, which would affect receptors directly, is considered to be potentially high, before dust controls; however, with the application of controls, the risk of impacts would be expected to be reduced such that the effect is not significant. Furthermore, the impact is predicted to be of local spatial extent, short term duration, intermittent and effects are not anticipated to continue beyond the decommissioning phase (i.e. they are predominantly reversible).

9.11.3.8 In lieu of appropriate information, the maximum design scenario has been adopted (Table 9.10).

9.11.3.9 Table 9.39 shows the magnitude of dust impact during the decommissioning phase of Hornsea Three as worst-case without any mitigation or dust-control measures, as required by the IAQM Guidance. Nevertheless, the significance of effect described in the following section does assume that the design measures in Table 9.29 have been adopted, reducing the significance compared to if no measures were adopted.

Table 9.37: Dust Emission Magnitude for demolition, earthworks, construction and trackout during the decommissioning phase.

Demolition	Earthworks	Construction	Trackout
Medium	Large	Small	Large

Sensitivity of the receptor

9.11.3.10 The sensitivity of the receptor in the decommissioning phase is expected to be the same or similar to the sensitivity of the receptor in the construction phase as discussed in section 9.11.1.

Significance of effect

9.11.3.11 The Dust Emission Magnitude has been considered in the context of the Sensitivity of the Area to give the Risk of Dust Impacts. Table 9.38 summarises the risk of dust impacts associated with the decommissioning phase of Hornsea Three for the four activities.

Table 9.38: Risk of Dust Impacts for demolition, earthworks, construction and trackout during the decommissioning phase of Hornsea Three.

Potential impact	Source							
	Demolition		Earthworks		Construction		Trackout	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Potential impact of dust soiling	Medium	Negligible	High	Negligible	Low	Negligible	High	Negligible
Potential impact on human health	Low	Negligible	Low	Negligible	Negligible	Negligible	Low	Negligible
Potential impact on ecological receptors	Medium	Negligible	High	Negligible	Low	Negligible	High	Negligible
Risk	**Medium**	**Negligible**	**High**	**Negligible**	**Low**	**Negligible**	**High**	**Negligible**

9.11.3.12 In the absence of dust controls, the overall dust impact risk for demolition and construction is medium, and the dust impact risk for earthworks and track-out is high. Taking the site as a whole, the risk is deemed to be high. The dust control measures appropriate to a level of risk for the site as a whole and for each of the phases are set out in Table 9.29. As noted above, the IAQM guidance recommends that significance is only assigned to the effect after the recommended controls have assumed to be put in place.

9.11.3.13 The effect with the IAQM recommended dust controls in place will, therefore, be **not significant** in EIA terms.

Temporary impacts due to traffic that may affect human and ecological receptors during the decommissioning phase

9.11.3.14 The temporary impacts of traffic generated during the Hornsea Three decommissioning phase may affect human and ecological receptors.

9.11.3.15 The number of daily vehicle trips generated during the decommissioning phase of Hornsea Three is expected to be less than that of the construction phase. Taking into account reductions in background concentrations of air pollutants due to improvements in vehicle emissions, it is anticipated that impacts during the decommissioning phase will be lower than those during the construction phase of Hornsea Three.

9.11.3.16 The results of the modelling indicate that during the construction phase of Hornsea Three, the predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at existing receptors are well below the relevant long and short-term AQS objectives. When the magnitude of change in annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations is considered in the context of the absolute predictions, the air quality impacts of Hornsea Three on existing receptors are categorised as 'negligible'. Taking into account the geographical extent of the impacts predicted in this study, the overall impact of the construction phase of Hornsea Three on the surrounding area as a whole is considered to be 'negligible', using the descriptors adopted for this assessment.

9.11.3.17 Using professional judgement, the resulting air quality effect during the decommissioning phase will also be considered to be **not significant** overall.

9.11.3.18 For further assessment of ecological impacts see chapter 3: Ecology and Nature Conservation.

Future monitoring

9.11.3.19 With the exception of dust monitoring set out in Table 9.29, no other monitoring is considered necessary to test the predictions made within the decommissioning phase impact assessment.

9.12 Cumulative Effect Assessment methodology

9.12.1 Screening of other projects and plans into the Cumulative Effect Assessment

9.12.1.1 The Cumulative Effect Assessment (CEA) takes into account the impact associated with Hornsea Three together with other projects and plans. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise undertaken as part of the 'CEA long list' of projects (see volume 4, annex 5.2: Cumulative Effects Screening Matrix and Location of Schemes). Each project on the CEA long list has been considered on a case by case basis for scoping in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

9.12.1.2 In undertaking the CEA for Hornsea Three, it is important to bear in mind that other projects and plans under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside Hornsea Three. For example, relevant projects and plans that are already under construction are likely to contribute to cumulative impact with Hornsea Three (providing effect or spatial pathways exist), whereas projects and plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors. For this reason, all relevant projects and plans considered cumulatively alongside Hornsea Three have been allocated into 'Tiers', reflecting their current stage within the planning and development process. This allows the CEA to present several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each Tier in the decision making process when considering the potential cumulative impact associated with Hornsea Three (e.g. it may be considered that greater weight can be placed on the Tier 1 assessment relative to Tier 2). An explanation of each tier is included below:

- Tier 1: Hornsea Three considered alongside:
    - Those with consent, and, where applicable (i.e. for low carbon electricity generation projects), that have been awarded a Contract for Difference (CFD) but have not been implemented; and/or
    - Those currently operational that were not operational when baseline data was collected, and/or those that are operational but have an on-going impact.
- Tier 2: All projects/plans considered in Tier 1, as well as:
    - Those project/plans that have consent but, where relevant (i.e. for low carbon electricity generation projects) have no CFD; and/or
    - Submitted but not yet determined.
- Tier 3: All projects/plans considered in Tier 2, as well as those on relevant plans and programmes likely to come forward but have not yet submitted an application for consent (the PINS programme of projects and the adopted development plan including supplementary planning documents are the most relevant sources of information from the relevant planning authorities regarding planned major works being consulted upon, but not yet the subject of a consent application). Specifically, this Tier includes all projects where the developer has advised PINS in writing that they intend to submit an application in the future, those projects where a Scoping Report is available and/or those projects which have published a PEIR.

9.12.1.3 It is noted that offshore wind farms seek consent for a maximum design scenario and the as built offshore wind farm will be selected from the range of consented scenarios. In addition, the maximum design scenario quoted in the application (and the associated Environmental Statement) are often refined during the determination period of the application. For example, it is noted that the Applicant for Hornsea Project One considered a maximum of 332 turbines within the Environmental Statement, but has gained consent for 240 turbines. Similarly, Hornsea Project Two has gained consent for an overall maximum number of turbines of 300, as opposed to 360 considered in the Environmental Statement and the as built number of turbines is likely to be less than this. A similar pattern of reduction in the project envelope from that assessed in the Environmental Statement, to the consented envelope and the 'as built' project is also seen across other offshore wind farms of relevance to this CEA. This process of refinement can result in a reduction to associated project parameters, for example, the number of cable trenches or the height of onshore substations. The CEA presented in this air quality chapter has been undertaken on the basis of information presented in the Environmental Statements for the other projects, plans and activities. Given that this broadly represents a maximum design scenario, the level of impact on air quality would likely be reduced from those presented here.

9.12.1.4 The schemes listed in Table 9.39 have been considered in the cumulative assessment for air quality. Detailed consideration of the potential for cumulative impacts has been limited to the construction phase, because air quality impacts from the operation and maintenance phase of Hornsea Three are expected to be negligible. Effects during decommissioning would be of a similar nature to construction but would be lower and thus construction represents the worst case. The Hornsea Three air quality (construction dust and traffic emissions) study area for cumulative assessment for air quality is 350 m from the onshore elements of Hornsea Three (see Figure 9.1). The basis for this is that at a distance greater than 350 m from construction activities the IAQM guidance advises that impacts are expected to be 'negligible'. Therefore, schemes within 350 m could potentially have a cumulative air quality impact if their construction activities take place during the same period.

9.12.1.5 The specific projects scoped into this CEA and the Tiers into which they have been allocated, are outlined in Table 9.39. The projects included as operational in this assessment have been commissioned since the baseline studies for Hornsea Three were undertaken and as such were excluded from the baseline assessment.

9.12.1.6 No Tier 1 projects have been identified and therefore, only Tier 2 and 3 assessments have been undertaken.

Table 9.39: List of other projects and plans considered within the CEA

Tier	Phase	Project/Plan	Distance from Hornsea Three	Details	Date of Construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
2	Construction/Operation and Maintenance/Decommissioning	C/7/2014/7030	0 m	(I) For a southern extension to Mangreen Quarry and ancillary works with progressive restoration to agriculture and nature conservation by the importation of inert restoration materials; (II) Retention of existing consented facilities at Mangreen Quarry; (III) Establishment of crossing point over Mangreen Lane; and (IV) Proposed variation to approved restoration scheme at Mangreen Quarry. Approved 2 October 2017	2017 to 2024	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2011/1804/O	0 m	Residential led mixed use development of 1196 dwellings and associated uses including Primary School, Local Services (up to 1,850 sq.mtrs (GIA) of A1, A2, A3, A4, A5, D1 & B1 uses) comprising shops, small business units, community facilities/ doctors' surgeries, sports pitches, recreational space, equipped areas of play and informal recreational spaces. Extension to Thickthorn Park and Ride including new dedicated slip road from A11. Reserved matters (2017/0151)- proposed residential development (phase A1-B) comprising 91 dwellings including 20% affordable housing and associated open space and infrastructure. Approved 17 May 2017	2017 to 2026	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	20170052	303 m	Greater Norwich Food Enterprise Zone Approved 31 October 2017	Unknown	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2013/0092	7 m	Outline application for up to 20 residential units and associated highways works with all matters reserved	2021 to 2022	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2014/2611	21 m	The erection of 890 dwellings; the creation of a village heart to feature an extended primary school, a new village hall, a retail store and areas of public open space; the relocation and increased capacity of the allotments; and associated infrastructure including public open space and highway works.	2018 to 2028	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	20170789	55 m	Erection of Grain Store (Revised Proposal) Full Approval 19 July 2017	2020	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	20151644	310 m	Demolition of 4 Existing Units and Development of 10 Residential Units, Together with Associated Access (Outline) Approved 10 June 2016	2022-2024	Yes	Yes

Tier	Phase	Project/Plan	Distance from Hornsea Three	Details	Date of Construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
2	Construction/Operation and Maintenance/Decommissioning	2015/1697	312 m	Erection of 27 dwellings, access, roads, open space, parking areas and associated works. Approved 27 June 2016	2019 to 2020	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2012/1836	338 m	Outline application for residential development (20 Dwellings) and associated infrastructure works, including highway improvement works at the Mill Road/School Lane/Burnthouse Lane junction. Approved 29 April 2014	2018 to 2020	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2015/2082	922 m	Outline application for the residential development of 10 dwellings Approved 22 June 2016	2021 to 2022	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2012/1880	1.16 km	Proposed offices, laboratories and academic space for principally research and development activities, buildings for health and health related uses and buildings for further ancillary uses. Associated car parking, access, infrastructure, internal access roads and strategic landscaping. Approved 23 August 2013	2017 to 2026	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2013/1494	1.21 km	Outline planning application with all matters reserved (save access) for the creation of up to 650 residential dwellings (use class C3), up to 2,500 sq.mtrs of use class A1, A2, A3, A4, A5 and D1 floorspace, together with highways works, landscaping, public realm, car parking and other associated works. Appeal Allowed 7 January 2016	2019 to 2024	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2013/1793	1.64 km	Outline planning permission for a development for up to 650 dwellings together with a small local centre, primary school with early years facility, two new vehicular accesses off Colney Lane, associated on-site highways, pedestrian and cycle routes, public recreational open space, allotments, landscape planting and community woodland. Approved 20 July 16	2019 to 2028	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	2012/1477	1.84 km	Outline application for new offices and laboratories for research and development activities along with ancillary and complimentary uses with access from Colney Lane and Hethersett Lane and all other matters reserved. Demolition and reprovision of existing buildings. Associated car parking, infrastructure, internal access roads, landscaping and cycle parking. Approved 13 June 2013	2017 to 2026	Yes	Yes

Tier	Phase	Project/Plan	Distance from Hornsea Three	Details	Date of Construction (if applicable)	Overlap of construction phase with Hornsea Three construction phase	Overlap of operation phase with Hornsea Three operation phase
2	Operation and Maintenance	TR010015	1.93 km	The Norwich Northern Distributor Road (NDR) is a 20km dual carriageway road under construction to run from the A47 at Postwick, east of Norwich, to the A1067 Fakenham Road north of Taverham."	Finishing in 2018	Yes	Yes
	Construction/Operation and Maintenance/Decommissioning	PO/16/0253	2.08 km	Erection of up to 215 dwellings, employment land (A3, A4, B1, B2, B8, C1, C2, D1 and D2 class uses), public open space and provision of roundabout and vehicular link road from Cromer Road (A148) to Heath Drive with associated landscaping and infrastructure (Outline application) Approved 15 August 2016	2019 to 2025	Yes	Yes
3	Construction/Operation and Maintenance/Decommissioning	EN010079	0 m	Norfolk Vanguard is a proposed offshore windfarm with an approximate capacity of 1800 MW off the coast of Norfolk. Pre-application stage PEIR October 2017	2020-2024	Yes	Yes

9.12.2 Maximum design scenario

9.12.2.1 The maximum design scenarios identified in Table 9.40 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative impact presented and assessed in this section have been selected from the details provided in the Hornsea Three project description (volume 1, chapter 3: Project Description), as well as the information available on other projects and plans, in order to inform a 'maximum design scenario'. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the project Design Envelope (e.g. different turbine layout), to that assessed here be taken forward in the final design scheme.

Table 9.40: Maximum adverse scenario considered for the assessment of potential cumulative impacts on air quality

Potential impact	Maximum design scenario	Justification
Construction phase		
Temporary impacts during construction of Hornsea Three that may affect receptors sensitive to dust (human and ecological).	Tier 2 - C/7/2014/7030 Tier 2 - 2011/1804/O Tier 3 - EN010079	The construction phase of these projects potentially overlaps with the construction of Hornsea Three. When considering these projects in combination with Hornsea Three there may be a cumulative effect on air quality. The greatest potential for cumulative impacts to occur with those projects immediately adjacent to the onshore elements of Hornsea Three.
Temporary impacts due to traffic that may affect human and ecological receptors during the construction phase		
Decommissioning phase		
Temporary impacts during the decommissioning phase of Hornsea Three that may affect receptors sensitive to dust (human and ecological).	Tier 2 - C/7/2014/7030 Tier 2 - 2011/1804/O Tier 3 - EN010079	The deconstruction phase of these projects potentially overlaps with the construction of Hornsea Three. When considering these projects in combination with Hornsea Three there may be a cumulative effect on air quality. The greatest potential for cumulative impacts to occur with those projects immediately adjacent to the onshore elements of Hornsea Three.
Temporary impacts due to traffic that may affect human and ecological receptors during the decommissioning phase		

9.13 Cumulative Effect Assessment

9.13.1.1 A description of the significance of cumulative effects upon air quality receptors arising from each identified impact is given below.

9.13.2 Construction Phase

Temporary impacts during construction of Hornsea Three that may affect receptors sensitive to dust (human and ecological).

9.13.2.1 In the event that the construction programmes for other Tier 2 and Tier 3 schemes overlap with Hornsea Three, the most significant issue in relation to local air quality effects is likely to be the potential for temporary impacts caused by the deposition of dust during the construction phase.

Magnitude of impact

9.13.2.2 With the IAQM recommended dust controls in place (as would be standard best practice), the magnitude of impacts from cumulative developments are expected to be the same or similar to the impacts from construction at the onshore HVAC booster station, HVDC converter/HVAC substation and the Hornsea Three landfall area (see Table 9.30).

Sensitivity of the receptor

9.13.2.3 The sensitivity of the receptor is expected to be the same or similar to the impacts from construction at onshore HVAC booster station, HVDC converter/HVAC substation and the Hornsea Three intertidal area, as detailed in Table 9.31 and Table 9.32.

Significance of effect

9.13.2.4 Provided that the cumulative developments use the recommended IAQM dust controls, the effect will be **not significant** in EIA terms.

9.13.2.5 For further assessment of ecological impacts see chapter 3: Ecology and Nature Conservation.

Temporary impacts due to traffic that may affect human and ecological receptors during the construction phase

9.13.2.6 In the event that the construction programmes for other schemes overlap with Hornsea Three, the most significant issue in relation to local air quality effects is likely to be the temporary increase in air pollutants caused by the addition of construction traffic from multiple schemes to the local road network.

9.13.2.7 The air quality assessment of construction-phase effects has taken cumulative effects into account to the extent that committed developments are included within the traffic model (see chapter 7: Traffic and Transport). Any other committed developments within the local area that have not been included within the traffic model are likely to result in additional cumulative effects to the results reported in this chapter.

9.13.2.8 Cumulative air quality impacts at existing receptors are likely to be **not significant**; as the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are well below the relevant AQS objectives.

9.13.2.9 For further assessment of ecological impacts see chapter 3: Ecology and Nature Conservation.

Future monitoring

9.13.2.10 With the exception of dust monitoring set out in Table 9.29 and the outline CoCP (document reference A8.5), no other monitoring is considered necessary to test the predictions made within the construction phase cumulative impact assessment.

9.13.3 Decommissioning Phase

Temporary impacts during decommissioning of Hornsea Three that may affect receptors sensitive to dust (human and ecological).

9.13.3.1 The air quality impacts during decommissioning would be of a similar nature to construction but would be smaller and thus construction represents the maximum design scenario. Therefore, the impact would be no greater than for those outlined in 9.13.2.4. Therefore, provided that the cumulative developments use the recommended IAQM dust controls, the effect will be **not significant** in EIA terms.

Temporary impacts due to traffic that may affect human and ecological receptors during the decommissioning phase

9.13.3.2 The air quality impacts during decommissioning would be of a similar nature to construction but would be smaller and thus construction represents the maximum design scenario. Therefore, the impact would be no greater than for those outlined in 9.13.2.8. Therefore, cumulative air quality impacts at existing receptors are likely to be **not significant**; as the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are well below the relevant AQS objectives.

Future monitoring

9.13.3.3 With the exception of dust monitoring set out in Table 9.29, no other monitoring is considered necessary to test the predictions made within the decommissioning phase cumulative impact assessment.

9.14 Transboundary effects

9.14.1.1 A screening of transboundary impacts has been carried out and is presented in volume 4, annex 5.4: Transboundary Impacts Screening Note. This screening exercise identified that there was no potential for significant transboundary effects with regard to air quality from Hornsea Three upon the interests of other EEA States.

9.15 Inter-related effects

9.15.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the project (construction, operation and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three key project stages (e.g. subsea noise effects from piling, operational turbines, vessels and decommissioning).
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on air quality, such as construction dust and vehicle emissions, may interact to produce a different or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

9.15.1.2 A description of the likely inter-related effects arising from Hornsea Three on air quality is provided in chapter 11: Inter-Related Effects (Onshore).

9.16 Conclusion and summary

9.16.1.1 Baseline air quality in the Hornsea Three air quality (construction dust and traffic emissions) study areas was collected through a detailed desktop review of existing monitoring studies and publicly-available datasets for particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). Based on a review of these datasets, the most appropriate air quality baseline was identified for the rural location of Hornsea Three.

9.16.1.2 A risk-based assessment of potential impacts from construction dusts has been undertaken for demolition earthworks, construction and track-out development, using the IAQM method. Using this approach, described in detail in section 9.10.1, the dust effects associated with construction activity after implementation of the proposed control measures would be not significant in EIA terms.

9.16.1.3 Detailed atmospheric dispersion modelling has been undertaken for the first year in which the Hornsea Three is being constructed, i.e. 2022. Traffic emissions from construction traffic for the Hornsea Three are predicted to generate a 'negligible' impact on existing receptors in the local area taking into account the changes in pollutant concentrations and absolute levels. Using the criteria adopted for this assessment together with professional judgement, the overall impact on the area as a whole is described as '**negligible**'.

9.16.1.4 In the event that the construction programmes for cumulative developments overlap, the most significant issue in relation to local air quality effects is likely to be temporary disamenity caused by the deposition of dust during the construction phase and with appropriate dust controls, impacts could be expected to be minimal. Assuming that the cumulative developments implement the recommended IAQM dust controls the magnitude of impacts from cumulative developments are expected to be the same or similar to the impacts from construction at the onshore HVAC booster station, HVDC converter/HVAC substation and the Hornsea Three landfall area. The effect would be **not significant** in EIA terms.

9.16.1.5 Screening of potential transboundary impacts (as presented in volume 4, annex 5.4: Transboundary Impacts Screening Note) has identified that there was no potential for significant transboundary effects with regard to air quality.

9.16.1.6 A summary of the findings of the air quality EIA are presented in Table 9.41.

Table 9.41: Summary of potential environment effects, mitigation and monitoring.

Description of impact	Measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Construction Phase							
The temporary impacts during the construction of Hornsea Three may affect receptors sensitive to dust (human and ecological).	Table 9.29	High without dust and control measures	Medium to High	**Not significant** with designed-in dust controls in place	N/A	N/A	None
The temporary impacts due to traffic may affect human and ecological receptors during the construction phase	No measures adopted	Negligible	High	**Negligible**	N/A	N/A	None
Operation and Maintenance Phase							
N/A							
Decommissioning Phase							
The temporary impacts of decommissioning of Hornsea Three may affect receptors sensitive to dust (human and ecological).	Table 9.29	High without dust control measures	Low to High	**Not significant** with designed-in dust controls in place	N/A	N/A	None
The temporary impacts due to traffic may affect human and ecological receptors during the decommissioning phase	No measures adopted	Negligible	High	**Negligible**	N/A	N/A	None

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