NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

APFP Regulation 5(2)(a), 5(2)(g)

Infrastructure (Environmental Impact Assessment) Regulations 2017

North Lincolnshire Green Energy Park

Volume 5

5.9 Report to Inform Habitat Regulations Assessment

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CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

Name	Description
AA	Appropriate Assessment
APIS	Air Pollution Information System
CHP	Combined Heat and Power
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DHPWN	District Heat and Private Wire Network
EA	Environment Agency
EC	European Commission
EIA	Environmental Impact Assessment
ERF	Energy Recovery Facility
FCS	Favourable Conservation Status
HRA	Habitats Regulations Assessment
IROPI	Imperative Reasons of Overriding Public Interest
LSE	Likely Significant Effect
NLGEP	North Lincolnshire Green Energy Park
NSER	No Significant Effect Report
NSIP	Nationally Significant Infrastructure Project
PC	Process Contribution
PEC	Predicted Environmental Contribution
PEIR	Preliminary Environmental Information Report
SAC	Special Area of Conservation
SoS	Secretary of State
SPA	Special Protection Area

1. INTRODUCTION

1.1 Purpose of this Report

1.1.1.1 North Lincolnshire Green Energy Park (NLGEP) (The Project) is classified as a Nationally Significant Infrastructure Project (NSIP) under sections 14 and 15 of The Planning Act 2008, as the generating capacity will be in excess of 50 megawatts electrical power (MW). It will therefore be consented under the Development Consent Order (DCO) regime.

1.1.1.2 If an application for an NSIP is likely to affect a European designated site and / or a European marine site of nature conservation importance[1], a report must be provided with the application showing the site(s) that may be affected together with sufficient information to enable the competent authority (the Secretary of State (SoS)) to make an Appropriate Assessment (AA), if required. This process is referred to as a Habitats Regulations Assessment (HRA).

1.1.1.3 This report presents the Report to inform Habitats Regulations Assessment (HRA) for the Project (including HRA Stage 1: Screening and HRA Stage 2: AA), which is required as part of the DCO submission as described in the Planning Inspectorate's Advice Note 10[2]. The set of matrices developed by the Planning Inspectorate and required to provide a summary of Stage 1 and 2 of the HRA in a standardised form are presented in Appendix 1 to this chapter.

1.2 The Project

1.2.1.1 The North Lincolnshire Green Energy Park (NLGEP) ('the Project'), located at Flixborough, North Lincolnshire, is a Nationally Significant Infrastructure Project (NSIP) with an Energy Recovery Facility (ERF) capable of converting up to 760,000 tonnes of non-recyclable waste into 95 MW of electricity at its heart and a carbon capture, utilisation and storage (CCUS) facility which will treat the excess gasses released from the ERF to remove and store carbon dioxide (CO_2) prior to emission into the atmosphere.

1.2.1.2 The NSIP incorporates a switchyard, to ensure that the power created can be exported to the National Grid or to local businesses, and a water treatment facility, to take water from the mains supply or recycled process water to remove impurities and make it suitable for use in the boilers, the CCUS facility, concrete block manufacture, hydrogen production and the maintenance of the water levels in the wetland area.

1.2.1.3 The Project will include the following Associated Development to support the operation of the NSIP:

[1] European sites comprise: Sites of Community Importance (SCI), Special Areas of Conservation (SAC), candidate SACs (cSAC), possible SACs (pSAC), Special Protection Areas (SPA), potential SPAs (pSPA) and, under UK law, Ramsar sites.

[2] Advice Note 10: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. The Planning Inspectorate. Republished November 2017, Version 8.

- a bottom ash and flue gas residue handling and treatment facility (RHTF)
- a concrete block manufacturing facility (CBMF)
- a plastic recycling facility (PRF)
- a hydrogen production and storage facility
- an electric vehicle (EV) and hydrogen (H2) refuelling station
- battery storage
- a hydrogen and natural gas above ground installations (AGI)
- a new access road and parking
- a gatehouse and visitor centre with elevated walkway
- railway reinstatement works including, sidings at Dragonby, reinstatement and safety improvements to the 6km private railway spur, and the construction of a new railhead with sidings south of Flixborough Wharf
- a northern and southern district heating and private wire network (DHPWN)
- habitat creation, landscaping and ecological mitigation, including green infrastructure and 65 acre wetland area
- new public rights of way and cycle ways including footbridges
- Sustainable Drainage Systems (SuDS) and flood defence; and
- utility constructions and diversions.

1.2.1.4 The Project will also include development in connection with the above works such as security gates, fencing, boundary treatment, lighting, hard and soft landscaping, surface and foul water treatment and drainage systems and CCTV.

1.2.1.5 The Project also includes temporary facilities required during the course of construction, including site establishment and preparation works, temporary construction laydown areas, contractor facilities, materials and plant storage, generators, concrete batching facilities, vehicle and cycle parking facilities, offices, staff welfare facilities, security fencing and gates, external lighting, roadways and haul routes, wheel wash facilities, and signage.

1.2.1.6 The overarching aim of the Project is to support the UK's transition to a low carbon economy as outlined in the Sixth Carbon Budget (December 2020), the national Ten Point Plan for a Green Industrial Revolution (November 2020) and the North Lincolnshire prospectus for a Green Future. It will do this by enabling circular resource strategies and low-carbon infrastructure to be deployed as an integral part of the design (for example by reprocessing ash, wastewater and carbon dioxide to manufacture concrete blocks and capturing and utilising waste-heat to supply local homes and businesses with heat via a district heating network).

1.2.1.7 Further details about the Project are provided in Chapter 3 of the ES, The Project Description and Alternatives (**Document Reference 6.2.3**)

2. APPROACH TO THE HRA

2.1 Overview

2.1.1.1 The approach to the HRA follows the guidance set out in the Planning Inspectorate's Advice Note 10. It has also taken account of a range of other guidance material including that produced by Defra (2021)[3], the European Commission (EC) (e.g. 2011[4], 2018[5]), the DTA Habitats Regulations Handbook[6] and case law. Other specific guidance in relation to HRA and air quality is considered in Section 3.1.

2.1.1.2 The process comprises four main stages:

- Stage 1 Screening to identify the likely effects of a project on a European site and consider whether the effects are likely to be significant;
- Stage 2 Appropriate Assessment to determine whether the integrity of the European site will be adversely affected by the project;
- Stage 3 Assessment of Alternative Solutions to establish if there are any that will result in a lesser effect on the European site; and
- Stage 4 Imperative Reasons of Overriding Public Interest (IROPI) and Compensatory Measures to establish whether it is necessary for the project to proceed despite the effects on the European site, and to confirm that necessary compensatory measures are in place to maintain the coherence of the national site network.

2.1.1.3 Each of the above stages is discussed in more in the following sections.

2.2 Stage 1 – Screening

2.2.1.1 The screening stage examines the likely effects of a project either alone, or in combination with other projects and plans on a European site, and seeks to answer the question "can it be concluded that no likely significant effect will occur?" To determine if the construction and / or operation of the Project[7] is likely to have any significant effects on the designated sites, the following issues have been considered:

- could the proposals affect the qualifying interest and are they sensitive / vulnerable to the effect;
- the probability of the effect happening;

[3] Habitats Regulations Assessments: Protecting a European Site (2021)

[4] European Commission (2011) *Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones with Particular Attention to Port Development and Dredging*. EC.

[5] European Commission (2018) Managing Natura 2000 Sites – The Provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. EC.

[6] Tyldesley, D. and Chapman, C. (2013) The Habitats Regulations Assessment Handbook, July 2021 edition UK: DTA Publications Limited.

[7] It has been assumed that any effects from decommissioning would be addressed in full by the Competent Authority closer to the time when it may occur, based on more specific information about the activities and processes involved, and also the prevailing environmental conditions.

- the likely consequences for the site's conservation objectives if the effect occurred; and
- the magnitude, duration and reversibility of the effect, taking into account any mitigation built into the project design.

2.2.1.2 The screening stage has therefore sought to conclude one of the following outcomes:

- no likely significant effect;
- a likely significant effect will occur; or
- it cannot be concluded that there will be no likely significant effect.

2.2.1.3 Where the assessment concludes the second or third outcome, then the need for an AA is triggered[8].

2.2.1.4 Natural England's internal guidance[9] states in paragraphs 4.3 to 4.5 that:

> 4.3 "In undertaking an assessment of 'likely significant effects' under the Habitats Regulations, authoritative case law has established that:
>
> - an effect is likely if it 'cannot be excluded on the basis of objective information' (Case C-127-02 Waddenzee – refer para 45)
> - an effect is significant if it 'is likely to undermine the conservation objectives' (Case C-127-02 Waddenzee – refer para 48)
> - in undertaking a screening assessment for likely significant effects 'it is not that significant effects are probable, a risk is sufficient'… but there must be credible evidence that there is 'a real, rather than a hypothetical, risk' (Boggis v Natural England and Waveney DC (2009) EWCA Civ 1061 – refer paras 36-37)
>
> 4.4 The Advocate General's opinion in Sweetman also offers some simple guidance that the screening step 'operates merely as a trigger' which asks 'should we bother to check?' (Case C-258/11 Sweetman Advocate General Opinion (refer paras 49-50).
>
> 4.5 As such, when determining whether air pollution from a plan or project has a 'likely significant effect' upon a given qualifying feature under the Habitats Regulations, the extent to which there are risks of air pollution that might undermine the conservation objectives for the site is central."

2.2.1.5 Recent case law has also confirmed that measures intended to avoid, or reduce, the harmful effects of a project on a European site should not be taken into account at the screening stage (C-323/17 People over Wind). Such matters are to be taken into account as part of an AA. However, from an air quality perspective the assessment does take into account the embedded measures that are required to meet emission limits and air quality standards designed for the protection of human health.

[8] In the case of the third outcome, European guidance (*Assessment of Plans and Projects Significantly affecting Natura 2000 sites (2001)*) advises that sufficient uncertainty remains to indicate that an appropriate assessment should be carried out.

[9] Natural England Internal Guidance (2018) Approach to advising competent authorities on Road Traffic Emissions and HRAs V1.4 Final. NE.

2.2.1.6 The screening assessment also has to include a consideration of other projects and whether likely significant effects to European sites may result in combination with these other projects.

2.2.1.7 Other projects and plans that will be considered as part of the in-combination assessment will be agreed with the Competent Authority (in this case the Planning Inspectorate) and based on advice from Natural England and the Environment Agency. Account will be taken of case law including from Walton and Fraser v Scottish Ministers (2011)[10] and the Application for Judicial review by Newry Chamber of Commerce (2015)[11].

2.2.1.8 In drawing up the list of other projects and plans, account will be taken also of the need to avoid "legislative overkill" that could occur through the inclusion of "… all plans and projects capable of having any effect whatsoever…" (Case C-258/11 Sweetman v An Board Pleanála (2013)[12]) and that there is credible evidence that the risk from these other projects and plans is real (see reference to Boggis above). This will include consideration of the likely effects of the project / plans on the conservation objectives of the European site(s) affected (Section 3.3).

2.3 Stage 2 – Appropriate Assessment

2.3.1.1 Where an AA is required, its aim is to determine if the effects of a project will have an adverse effect on European sites. It should provide and analyse sufficient information to allow the competent authority to make this determination. AA should exclusively focus on the qualifying features of the European site, and it must consider any effects on the conservation objectives of those qualifying interests. It should also be based on, and supported by, evidence that is capable of standing up to scientific scrutiny. EC guidance states that without proper reasoning the assessment does not fulfil its purpose, and cannot be considered "appropriate" and therefore cannot be consented. In terms of what is reasonable, guidance states "to identify the potential risks, so far as they may be reasonably foreseeable in the light of such information as can be reasonably obtained"[13].

2.3.1.2 In undertaking an AA, there are two stages:

- a scientific evaluation of all the likely significant effects of a project alone, or in-combination with other projects, on the relevant qualifying interests of a European site; and
- a conclusion based on outcomes of the scientific evaluation as to whether the integrity of a European site will be compromised.

2.3.1.3 The emphasis for AA is to prove that no adverse effects due to a project will occur which would undermine a European site's conservation integrity. Site integrity can be defined as: "the coherence of its structure and function

[10] 2011 SCLR 686, [2011] CSOH 131, [2011] ScotCS CSOH_131, 2011 GWD 34-703

[11] Neutral Citation No. [2015] NIQB 65

[12] In Case C-258/11

[13] Scottish Natural Heritage (SNH) (2001) Natura Casework Guidance: Consideration of Proposals Affecting SPAs and SACs. SNH Guidance Note Series. SNH.

across its whole area that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified"[14].

2.3.1.4 The assessment also needs to take into account any measures which will be implemented to avoid, or reduce the level of impact from a project. The Competent Authority may also consider the use of conditions or restrictions to help avoid adverse effects on site integrity.

2.3.1.5 If the AA concludes that there will be an adverse effect on the integrity of the European site, or that there is uncertainty and a precautionary approach is taken, then consent can only be granted if there are no alternative solutions, Imperative Reasons of Overriding Public Interest (IROPI) is applicable and compensatory measures have been secured.

2.4 Stage 3 – Assessment of Alternative Solutions

2.4.1.1 All feasible alternatives have to be analysed to ensure that there are none which "better respect the integrity of the site in question" and its contribution to the overall coherence of the Natura 2000[15] network (EC, 2018)[16]. Alternatives could include the location of the site, its scale and design, and the way in which it is constructed and operated. The "do nothing" option also has to be considered.

2.4.1.2 The comparison of alternatives should not allow other assessment criteria (e.g. economics) to overrule ecological criteria (EC, 2018). However, the same guidance also refers to the opinion for the case C-239/04[17], where the opinion of the Advocate General was that "the choice does not inevitably have to be determined by which alternative least adversely affects the site concerned. Instead, the choice requires a balance to be struck between the adverse effect on the integrity of the SPA and the relevant reasons of overriding public interest".

2.5 Stage 4 – Imperative Reasons of Overriding Public Interest (IROPI) and Compensation Measures

2.5.1.1 Where a development has an adverse effect on the integrity of a European site and there are no alternative solutions, consent can only be granted if there are imperative reasons of overriding public interest, including those of social or economic nature which would require the realisation of a project. A definition of "overriding public interest" does not occur in the directive; however examples considered are:

- human health, public safety or beneficial consequences of primary importance to the environment; and

[14] European Communities (2000) Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. EC

[15] Referred to as a 'national site network' in the UK

[16] European Commission (2018) Commission Notice. "Managing Natura 2000 sites. The Provisions of Artice 6 of the 'Habitats' Directive 92/43/EEC" Brussels, 21.11.2018 C(2018) 7621 final.

[17] Commission of the European Communities V Portuguese Republic (2006) Case C-239/04.

- any other reasons which are considered by the Competent Authority to be IROPI; or
- if the site does not host a priority habitat or species then IROPI must be demonstrated, and the reasons can include those of a social, or economic nature.

2.5.1.2 If the importance of a project is deemed to outweigh the effects which will result on the European site, and there are no alternatives, compensatory measures must be secured before consent is granted. Compensatory measures are independent of a project and are intended to offset the adverse effects of a project, corresponding specifically to the negative effects on habitats and species concerned.

2.5.1.3 To be acceptable, compensatory measures should:

- take account of the comparable proportions of habitats and species which are adversely affected;
- be within the same bio-geographical range within which the European site is located;
- provide functions that are comparable to those which justified the selection of the original site; and
- have clearly defined implementation and management objectives so the measures can achieve the aim of maintaining the overall coherence of the network.

2.6 Consultation

2.6.1.1 Table 2: Emissions and Relevant Environmental Standards presents excerpts from consultation responses on the PEIR which are relevant to the HRA.

Table 1: Consultation Responses

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
1. Air Quality			
Chapter 5, paragraph 4.13.1.1 indicates that the effects on habitats within 10 km of the Energy Recovery Facility (ERF) have been assessed. Both Appendix 2 and Chapter 5 indicate that a 10 km radius from the Project was used. 'Project', in this instance, is assumed to refer to the Order Limits. It is therefore unclear what search radius has been used and this should be clarified.	Natural England	In the PEIR, the Ecology and HRA assessments identified all designated sites within 10 km of the point of the main ERF stacks, given that this is the key emission point potentially impacting sensitive ecology. The air quality modelling was undertaken using a similar buffer of 10 km from the ERF stacks. The search area has been extended to 15 km from the ERF stack for the ES **(Document Reference 6.0).**	Section 3.3
Chapter 5 states that initial modelling indicates a negligible risk of significant effects beyond 10 km, and therefore screening to 15 km has not been undertaken for European sites. It should be noted that Natural England has not yet had sight of the results of the initial modelling, so we have not been able to refer to this in our response. However it is relevant that Thorne Moor SAC is located within 15 km of the Order Limits and is notified for H7120 Degraded raised bogs (still capable of natural regeneration). H7120 Degraded raised bogs are sensitive to nutrient nitrogen and acid deposition. Natural England therefore advises that screening up to a minimum of 15 km of the Order Limits should be undertaken. Due to the nature of the proposed development and habitat sensitivities, it may also be appropriate to consider Hatfield Moor SAC and Thorne and Hatfield Moors SPA.	Natural England	As a result of this advice from Natural England, air quality modelling has been extended to include a buffer of 15 km from the ERF stack. We note the presence of Hatfield Moor SAC just outside this buffer zone and will consider the need to include this site dependent on the modelling results. Thorne Moor SAC and Thorne and Hatfield Moors SPA are included within the 15 km search area and are considered in the assessment.	Section 4.2

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
Chapter 5, paragraph 4.2.2.7 states that "no habitats or species of the European sites were found to be sensitive to acid deposition". Acid deposition has therefore been scoped out of the assessment. APIS indicates that several interest features of the SPA are sensitive to acid deposition and therefore this should be scoped into the assessment.	Natural England	Where ecological receptors within 15 km of the Project have relevant site specific Critical Loads for Acid Deposition and Nutrient Nitrogen Deposition (as identified from APIS), these have been included in the Air Quality Impact Assessment and fed into the HRA and fed into the Report to inform Habitats Regulations Assessments (HRA) (**Document Reference 5.9).** The HRA acknowledges that a number of broad habitat types used by the SPA bird interest features are sensitive to acid deposition. However, APIS confirms that, for all relevant species, the bird species are not sensitive to any acidity impacts even if the broad habitat types are sensitive. Therefore, no qualifying interest features of the SPA were found to be sensitive to acid deposition.	Section 3.3
Water-based features at all sites in question have been scoped out as the nutrient nitrogen is thought to be influenced overwhelmingly by waterborne nutrient loadings and agricultural run-off rather than by deposition from the atmosphere. Natural England does not consider this suitable justification to scope out all aquatic features. Where a relevant environmental benchmark has been provided on APIS, these features should be assessed.	Natural England	This is noted. It is confirmed that environmental benchmarks have been used where they are provided by APIS e.g. salt marsh communities. The SAC water-based features that have been scoped out are: mudflats and sandflats not covered by seawater at low tide, river lamprey and sea lamprey. There are no environmental benchmarks provided on APIS for these features. APIS notes that marine and river habitats do not tend to be sensitive to air pollution impacts, or are dominated by other sources of inputs.	Section 4.2.2
Sand dune habitats have also been scoped out of the assessment for all sites in question. Dune systems are one of the most sensitive habitats to air pollution and, within the Humber Estuary SAC and SSSI, are already exceeding critical loads. Chapter 5, Section 8.3 summarises the findings of the Air Quality Impact Assessment (AQIA) and concludes that there are likely to be exceedances in nitrogen and acid deposition at Humber Estuary SSSI, SAC and SPA. Section	Natural England	The potential significant contributions for dune habitats identified in the Air Quality Impact Assessment in the PEIR were based on modelling that assumed all habitat types were located within 10 km of the ERF. In reality, this is not the case and the HRA takes the further step of looking at the specific habitat locations within each designated site. All of the sand dune habitats are located at least 45 km from the Project	Section 4.2.2

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
8.3 clearly identifies potentially significant contributions for dune habitats and concludes that detailed assessment is therefore required. Natural England are concerned then that dune habitats have not been included in the detailed assessments summarised in Appendix 2 and Chapter 5. Air quality impacts on sand dunes should be considered in further detail in the Appropriate Assessment.		and at this distance, effects on sand dunes as a result of air emissions will be negligible. Therefore effects on sand dunes have been scoped out of the Environmental Statement **(Document Reference 6.0**).	
7. Cumulative Impacts			
Finally, in-combination effects have not been considered at this stage and we would welcome this information when it becomes available.	Natural England	In-combination effects are now addressed in this report. We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18**).	Sections 4.6 and 5.5
The 'in-combination' requirement makes sure that the effects of numerous small proposals, which alone would not result in a significant effect, are assessed to determine whether their combined effect would be significant enough to require more detailed assessment. Natural England notes that the application site is in close proximity to a number of SSSIs. Based on the plans submitted, Natural England considers that the proposed development could have potential significant effects on the interest features for which the sites have been notified. Chapter 10 correctly identifies SSSIs for assessment.	Natural England	In-combination effects are now addressed in this report. We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18**). This includes assessing cumulative impacts on SSSIs in close proximity to the project.	Sections 4.6 and 5.5
Plans or projects that should be considered in the in-combination assessment include the following: ■ the incomplete or non-implemented parts of plans or projects that have already commenced; ■ plans or projects given consent or given effect but not yet started; ■ plans or projects currently subject to an application for consent or proposed to be given effect; ■ projects that are the subject of an outstanding appeal; ■ ongoing plans or projects that are the subject of regular review;	Natural England	In-combination effects are now addressed in this report. We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18**). This considers plans or projects as per the criteria outlined.	Sections 4.6 and 5.5

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
■ any draft plans being prepared by any public body; and ■ any proposed plans or projects published for consultation prior to application.			
When assessing the effects on designated sites, Natural England recommends that the search radius for be measured from the nearest point on the designated site to the proposal being assessed, or the nearest area of sensitive habitat, if known. This would likely identify those proposals which are likely to affect overlapping geographic extents within the designated site in question.	Natural England	In-combination effects are now addressed in this report and considered this search area. We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18)**. This considers the cumulative impact on ecological sites.	Sections 4.6 and 5.5
Chapter 18 of the PIER provides a list of projects to be included in an assessment of the potential in-combination effects. Keadby II Power Station has been identified for consideration within the baseline and is scoped out of the in-combination assessment. Natural England notes that the air quality screening assessment uses DEFRA Background Mapping dated 2018 and APIS background data dated 2017 - 2019. It is not clear whether emissions to air from Keadby II Power Station are included within these background data. The Applicant should make a thorough check that all relevant emissions are included in the baseline assessment.	Natural England	We have assessed cumulative impacts in Chapter 18: of the Environmental Statement (**Document Reference 6.2.18).** This considers emissions from Keadby 2 and Keadby 3. The assessment also considers the trends in the long term baseline on a regional, national and international basis, and assesses the overall likelihood of significant adverse impacts on sensitive ecological receptors due to in-combination effects	Sections 4.6, and 5.5 Section 4.6.1
10. Ecology			
Consideration of the Habitats Regulations is presented in Chapter 5 of the PEIR. Chapter 5 focusses solely on the potential effects of operational air quality. Paragraph 1.1.1.6 indicates that the screening matrices will include other potential effects arising from construction. Presumably this will be included with the Development Consent Order (DCO) submission. This should also consider other potential effects arising from operation. Natural England advises that the screening test should be carried out before the detailed assessment. Stage 1 of the Habitats Regulations	Natural England	This is noted and other effects (alone and in-combination) are now considered in this report.	Sections 4.5, 4.6.4 and 5.3

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
Assessment (HRA), the Likely Significant Effect (LSE) test, should identify the potential for all construction and operational impacts of the proposed development on each interest feature of the European sites in question, both alone and in-combination with other plans and projects. We will provide our advice on the HRA when the relevant information for this stage in the application has been provided.			
SACs are designated for rare and vulnerable habitats and species, whilst SPAs are classified for rare and vulnerable birds. Many of these sites are designated for mobile species that may also rely on areas outside of the site boundary. These supporting habitats may be used by SPA/SAC populations or some individuals of the population for some or all of the time. These supporting habitats can play an essential role in maintaining SPA/SAC species populations, and proposals affecting them may therefore have the potential to affect the European site. It should be noted that some of the potential impacts that may arise from the proposal relate to the presence of SPA interest features that are located outside the site boundary. Natural England advises that the potential for offsite impacts should be considered in assessing what, if any, potential impacts the proposal may have on European sites.	Natural England	This is noted. The potential for disturbance to qualifying interest bird species on functionally linked land is now considered in the HRA, as set out in Report to inform Habitats Regulations Assessment (**Document Reference 5.9).**	Sections 4.5, 4.6.4 and 5.3
Chapter 10, Appendix E Ornithology Surveys recorded a peak count of 42 mallard roosting and feeding along the banks of the River Trent. Mallard are an assemblage species of the Humber Estuary SPA / Ramsar and this represents 4% of the Humber Estuary population (based on a five year average from 2015/16 – 2019/20). The River Trent therefore is considered functionally linked land and the potential for bird disturbance should be a key consideration within the HRA.	Natural England	This is noted. The potential for disturbance to qualifying interest bird species on functionally linked land is considered in the HRA, as set out in the Report to inform Habitats Regulations Assessment (**Document Reference 5.9).**	Sections 4.5, 4.6.4 and 5.3

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
When identifying the potential for significant effects, we recommend that the seasonality of species designations be considered; for instance, whether there are records of a species during the season when it is identified as a designated site feature (e.g. during the breeding season). Although it is also worth considering impacts to those species at any time of year.	Natural England	This is agreed and is considered as part of the HRA as set out in the Report to inform Habitats Regulations Assessment (**Document Reference 5.9**).	Sections 4.5, 4.6.4 and 5.3
We welcome mitigation measures proposed in Chapter 10, Section 7. The specifics of these measures should be detailed in the Code of Construction Practice (CoCP) and Ecological Management Plan (EMP) which will need to be agreed with Natural England. Potential for noise, vibration and visual disturbance as a result of the construction and operation of the development should be a key consideration of the HRA process. Chapter 13 (Traffic and Transport), paragraph 8.2.5.3 indicates that there will be an additional 580 vessel movements per annum at Flixborough Wharf as a result of the proposed development. This represents a significant increase of 200% (when compared to 305 vessel movements in 2019) and should be considered within the HRA. As the development includes new access routes close to the designated site boundary, the HRA and SSSI assessment should also consider the potential for recreational disturbance impacts.	Natural England	The potential for disturbance (noise/vibration/visual) to qualifying interest bird features during construction and operation of the scheme is considered in the HRA. It is noted that the potential for recreational disturbance should also be included. The potential for disturbance (noise/vibration/visual) to qualifying interest bird features of the Humber Estuary SPA and Ramsar during construction and operation has been considered in the HRA – including the potential effect of vessel movement on birds using the River Trent. The potential for recreational disturbance has also been considered.	Sections 4.5, 4.6.4 and 5.3
21. Water Resources and Flood Risk			
It is understood that all water for use within the proposed development will be sourced from the Anglian Water mains supply, and all elements will be connected into a surface water drainage system and a sewerage system. Natural England welcomes mitigation measures proposed in Chapter 9, Section 7, as well as mitigation to prevent	Natural England	This is noted. The HRA considers the potential for impacts on water quality.	Section 4.5

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
leaching of construction pollutants into surface waters, as outlined in Chapter 9, paragraph 8.2.1.9. Potential for water quality impacts should be considered in the HRA.			

2.6.1.2 The consultation highlighted that the HRA should include an assessment of potential effects on European sites including the Humber Estuary Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site.

2.6.1.3 The Scoping Opinion also required that the spatial scope of the HRA should include a 30 km radius for SACs where bats are a qualifying feature, due to bat foraging distances. However, no SACs designated for their importance for bats were identified within 30 km of the Order Limits and this matter was not assessed further.

3. APPROACH TO ASSESSING THE EFFECTS ON HABITATS AND SPECIES FROM EMISSIONS TO AIR

3.1 Guidance

3.1.1.1 The approach to the assessment has taken account of the following guidance:

- DEFRA / EA guidance on Air Emissions Risk Assessment for Your Environmental Permit (as updated on 7 October 2020).
- DEFRA/ EA guidance on Environmental Permitting: Air Dispersion Modelling Reports (as updated on 19 January 2021).
- A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.0, June 2019). Institute of Air Quality Management (IAQM).
- CIEEM (2021) *Advice on Ecological Assessment of Air Quality Impacts.* Chartered Institute of Ecology and Environmental Management. Winchester, UK.
- Natural England Internal Guidance (2018) Approach to advising competent authorities on Road Traffic Emissions and HRAs V1.4 Final. NE.

3.1.1.2 Information about the relative sensitivity of qualifying interest habitats and plant species, and habitats supporting qualifying interest fauna species, was obtained from the Air Pollution Information System (APIS).

3.2 Critical Loads and Levels

3.2.1.1 The critical loads[18] and critical levels[19] for each habitat type were obtained from APIS and used as tools to assess the potential for effects of air pollutants on habitats. The critical load refers to the quantity of pollutant deposited from air to the ground, while the critical level is the gaseous concentration of a pollutant in the air.

3.2.1.2 Effects resulting from nitrogen and acid deposition have been assessed on a habitat and species-specific approach against critical loads listed in APIS. These specific loads are provided in the relevant tables in the Screening of Likely Significant Effects (see Section 4.3.1.3).

3.2.1.3 Critical levels (for the effects of NO_x, SO_2, NH_3 and HF) have been assessed against environmental standards that apply either across all habitat types (for NO_x and HF), or across lichens/bryophytes and vascular plants (for SO_2 and NH_3) as set out in Table 2.

[18] Critical Loads are defined as: "a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"

[19] Critical levels are defined as "concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge".

Table 2: Emissions and Relevant Environmental Standards

Substance	Emission period	Target (mean)
NOx	Annual	30 micrograms per cubic metre (µg m^{-3})
	Daily (24hr mean)	75 µg m^{-3}
SO_2	Annual	10 µg m^{-3} – where lichens / bryophytes are present
	Annual	20 µg m^{-3} – for all other vegetation
NH_3	Annual	1 µg m^{-3} – where lichens / bryophytes are present
	Annual	3 µg m^{-3} – for all other vegetation
HF	Weekly	0.5 µg m^{-3}
	Daily	5 µg m^{-3}

3.3 European Sites Search Area

3.3.1.1 Potential effects on habitats within 15 km of the main emission source at the ERF have been assessed, as recommended by Natural England (see Table 1). This is in line with current Defra / Environment Agency (EA) guidance[20] for some larger emitters.

3.3.1.2 European designated sites included in the search area were:

- SAC and candidate SACs;
- SPAs and potential SPAs; and
- Ramsar sites.

3.4 Screening Methodology

3.4.1.1 The Process Contribution (PC) is the environmental concentration at a receptor location of each substance emitted to air as a result of the Project.

3.4.1.2 Atmospheric dispersion modelling was undertaken to predict the short and long-term PC against the respective environmental standards. The screening approach to determine whether the PCs for the Project were insignificant, or required further assessment, was undertaken by comparing the PCs, and where necessary Predicted Environmental Contributions (PECs), against the percentages of the critical levels / loads for each habitat as set out in the Defra / EA guidance (Table 3).

3.4.1.3 The approach also takes account of the contribution of the Project along with other projects and plans as part of the in-combination assessment (Section 4.6).

[20] Air emissions risk assessment for your environmental permit (2016).

Table 3: Assessment Criteria for Habitats and Species

Criterion	Assessment
Long Term / Short Term	
■ PC < 1% of CL (long) and / or PC <10% of CL (short) ■ Or PC > 1% of CL (long) and / or >10% of CL (short) but PEC < 70% of CL	■ Insignificant contribution[21] and no further assessment required. Considered in the assessment to have no likely significant effect.
■ PC > 1% of CL (long) and / or >10% of CL (short) and PEC > 70% of CL	■ Cannot be considered as an insignificant contribution. Further assessment is required to determine the effects on habitats and species and whether, or not, they are likely to have an adverse effect on the integrity of a European site.

3.4.1.4 The levels and loads of air pollutants at habitats in the European sites within a 15 km radius from the main emission source at the ERF were predicted by the atmospheric dispersion modelling. Details about the model and its input data can be found in ES Chapter 5 Air Quality (**Document Reference 6.2.5**).

3.4.1.5 To assess the likely effects on European designated sites, the following methods were followed:

- Habitats that were not sensitive to specific air pollutants were screened out.
- Account was taken at this stage of the sensitivity of faunal species to potential effects on their supporting habitat. For example, APIS confirms that the qualifying interest bird species of the Humber Estuary SPA are not sensitive to the effects of acid deposition on their broad habitat types, so effects on these species were not considered further.
- Where qualifying interest features were present only in locations where they would clearly not be affected, they were excluded from consideration.
- In terms of nitrogen and acid deposition, the most sensitive habitat type amongst the qualifying interest features was selected. If the effects on this habitat type were found to be insignificant, it was assumed that effects on other qualifying features (with less stringent critical loads) would be similarly insignificant.
- Where the most sensitive qualifying interest feature of a designated site could not be screened out, the PCs were then predicted at other less sensitive habitats to assess the potential effect on all relevant habitats associated with the site.
- Where there were no identified critical loads on APIS, a view was taken on how likely the feature was to be affected and the likelihood of a real risk occurring as a result of the effects of air pollutants. For example, in the case of water-based features, the nutrient nitrogen will be

[21] The term 'significant' is used here in the context of its meaning within the Environment Agency guidance (ie making a 'significant contribution') and not within the context of the EIA Regulations 2017 (ie not necessarily leading to a 'likely significant effect').

influenced overwhelmingly by waterborne nutrient loadings and agricultural run-off rather than by deposition from the atmosphere, so these features were screened out.

- The APIS tool does not cover Ramsar sites. As the Humber Estuary Ramsar site protects the same habitats and species as the SAC and SPA designations, it was assumed that the modelling results for the SAC and SPA could be similarly applied to the Ramsar designation too.

3.5 Appropriate Assessment Methodology

3.5.1.1 Where European sites could not be screened out (including taking account of the in-combination assessment), further consideration was given to whether adverse effects on the integrity of the site were likely.

3.5.1.2 The analysis of the effects on site integrity was based on the effects of air emissions on particular habitats and the conservation objectives of each site. This analysis relied on professional judgement as there are no published criteria to determine whether a PC > 1% / PEC > 70% will result in an adverse effect on the integrity of a European site. The assessment took account of the factors listed below.

- The extent to which the PC was greater than 1% of the critical level / load.
- The background level of each pollutant and the PEC (i.e. PC + background) and whether the background levels / loads were sufficiently low to accommodate the predicted PC loads. As with the PC, there are no published criteria to determine whether a PEC of any level will be insignificant, or result in an adverse effect.
- The location of the relevant qualifying interest feature within the designated site, the extent of this feature affected by PCs > 1% and the variability in the occurrence of PCs > 1% over that area.
- The sensitivity within a habitat type. For example, saltmarsh that is exposed for longer periods (e.g. mature upper saltmarsh) is likely to be more sensitive to effects from pollutant concentrations in the air than those parts of the saltmarsh that are subject to regular inundation by water (e.g. lower to middle saltmarsh).
- The effects of Keadby 2 and Keadby 3 were considered in-combination.

4. SCREENING FOR SIGNIFICANT EFFECTS ON EUROPEAN SITES

4.1 Overview

4.1.1.1 This section sets out the European sites included in the assessment, the habitats and species that have been screened out, potential effects and the screening for any likely significant effects on the European sites.

4.2 European Sites

4.2.1.1 No European sites will be directly affected by the Project. Five European sites were identified within 15 km of the main emission source at the ERF, namely:

- Humber Estuary Special Area of Conservation (SAC);
- Humber Estuary Special Protection Area (SPA);
- Humber Estuary Ramsar site;
- Thorne Moor SAC; and
- Thorne & Hatfield Moors SPA.

4.2.1.2 Further details about these European sites are provided in Table 4and their locations are shown in Figure 4. The qualifying features for each site are summarised in Table 5.

4.2.1.3 The Humber Estuary SAC and Ramsar boundaries along the River Trent lie adjacent to the Order Limits of the Project around the Flixborough Industrial Estate. The elements of the Project that abut the boundary in this area are the existing port (Flixborough Wharf) and land to be used as a wetland/SUDs area, or other planted landscape screening mitigation, if required.

4.2.1.4 The presence of Hatfield Moor SAC just outside of the 15 km radius from the main emission source search area was noted during consultation. However, the air quality modelling showed that there was no potential for a significant effect on a site over 15 km from the ERF, so Hatfield Moor SAC was screened out and not considered further.

Table 4: European Sites

European Site Name, Site Code and Area	Distance from ERF stack (km)	Qualifying Features of Interest (Species and Annex I Habitats)
Humber Estuary SAC (UK0030170) 36657.15 ha	0.1 km west	**Annex I habitats that are a primary reason for selection of the site:** H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide **Annex I habitats and Annex II species present as a qualifying feature, but not a primary reason for site selection:** H1110: Sandbanks which are slightly covered by sea water all the time H1150: Coastal lagoons H1310: *Salicornia* and other annuals colonising mud and sand H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H2110: Embryonic shifting dunes H2120: Shifting dunes along the shoreline with *Ammophila arenaria* (marram grass) (“white dunes”) H2130: Fixed coastal dunes with herbaceous vegetation (“grey dunes”) H2160: Dunes with *Hippophae rhamnoides* (sea buckthorn) S1095: Sea lamprey (*Petromyzon marinus*) S1099: River lamprey (*Lampetra fluviatilis*) S1364: Grey seal (*Halichoerus grypus*)
Humber Estuary Ramsar (UK11031) 37987.8 ha	0.1 km west	Near natural estuary, supporting dune systems, estuarine waters, intertidal mud and sand flats, saltmarshes and saline lagoons. The Humber Estuary supports a breeding colony of grey seals at Donna Nook and a breeding site for natterjack toad in the dune slacks at Saltfleetby-Theddlethorpe. It is an important migration route for river and sea lamprey and supports an assemblage of waterfowl of international importance. Individual water bird qualifying species are: common shelduck (*Tadorna tadorna*), golden plover (*Pluvialis apricaria*), red knot (*Caladris canutus*), dunlin (*Caladris alpina*), black tailed godwit (*Limosa limosa*), bar-tailed godwit (*Limosa lapponica*) and common redshank (*Tringa totanus*).
Humber Estuary SPA (UK9006111)	6.5 km north	**Annex I Species:** avocet (*Recurvirostra avosetta*), great bittern (*Botaurus stellaris*), hen harrier (*Circus cyaneus*), golden plover, bar-tailed godwit, ruff (*Philomachus pugnax*), Eurasian marsh harrier (*Circus aeruginosus*) and little tern (*Sterna albifrons*).

European Site Name, Site Code and Area	Distance from ERF stack (km)	Qualifying Features of Interest (Species and Annex I Habitats)
37630.24 ha		**Regularly Occurring Migratory Species:** common shelduck, knot, dunlin, black tailed godwit and redshank. **Waterbird Assemblage:** 153,934 individual waterbirds (non-breeding) including dark-bellied brent goose (*Branta bernicla bernicla*), shelduck, wigeon (*Anas penelope*), teal (*Anas crecca*), mallard (*Anas platyrhynchos*), pochard (*Aythya ferina*), scaup (*Aythya marila*), goldeneye (*Bucephala clangula*), great bittern, oystercatcher (*Haematopus ostralegus*), avocet, ringed plover (*Charadrius hiaticula*), golden plover, grey plover (*Pluvialis squatarola*), lapwing (*Vanellus vanellus*), knot, sanderling (*Calidris alba*), dunlin, ruff, black-tailed godwit, bar-tailed godwit, whimbrel (*Numenius phaeopus*), curlew (*Numenius arquata*), redshank, greenshank (*Tringa nebularia*) and turnstone (*Arenaria interpres*).
Thorne Moor SAC (UK0012915) 1911.02 ha	10.1 km west	**Annex I habitats that are a primary reason for selection of the site:** 7120: Degraded raised bogs still capable of natural regeneration
Thorne & Hatfield Moors SPA (UK9005171) 2449.2 ha	10.1 km west	**Annex I Species:** European nightjar (*Caprimulgus europaeus*) - breeding

4.2.1.5 In general, the conservation objectives seek to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status (FCS) of its qualifying features, by maintaining or restoring:

- the extent and distribution of qualifying natural habitats and habitats of qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of qualifying species; and
- the distribution of qualifying species within the site.

4.2.2 Review of Qualifying Interest Location and Sensitivity to Air Emissions

4.2.2.1 The air quality modelling approach for nitrogen and acid deposition is habitat-specific. The locations of qualifying interest habitats and species were reviewed for the larger designated sites. Where features were only present at considerable distances from the Project they were screened out of the assessment.

4.2.2.2 For the Humber Estuary SAC / Ramsar site, many of the qualifying habitats and species are coastal or marine features, which do not occur within 15 km of the Project (where the potential for adverse effects has been identified). All the SAC / Ramsar dune habitats, coastal lagoons, Salicornia and other annuals colonising mud and sand, and grey seal *(Halichoerus grypus*) habitats all occur in the outer estuary at least 45 km from the Project and were therefore screened out. The Ramsar designation included a breeding site for natterjack toads on dune slacks which was also excluded due to distance.

4.2.2.3 Review of the Humber Estuary SAC citation and the distribution of priority habitats shown on the MAGIC website[22] established that the qualifying habitats and species that occur within 15 km of the Project are:

- estuaries and their component Atlantic salt meadows (saltmarsh);
- mudflats and sandflats not covered by seawater at low tide;
- sandbanks which are slightly covered by seawater all the time;
- river lamprey (*Lampetra fluviatilis*); and
- sea lamprey (Petromyzon marinus).

[22] Based on citation information and spatial data showing the distribution of designated habitats on the MAGIC website.

4.2.2.4 The qualifying interest habitats and species were then reviewed using information from APIS to establish their sensitivity to atmospheric pollutants. Estuaries and Atlantic salt meadows (saltmarsh) were identified as sensitive to nitrogen deposition, but were not sensitive to acid deposition.

4.2.2.5 For flowing water habitats, or habitats that are regularly inundated with water in the Humber Estuary SAC and Ramsar site, the nutrient nitrogen and acidity inputs will be predominantly from waterborne sources and agricultural run-off rather than air pollutants[23]. APIS confirms that 'sandbanks which are slightly covered by seawater all the time' are not considered to be sensitive to any of the pollutants in the assessment, therefore effects on this habitat type were screened out. 'Mudflats and sandflats not covered by seawater at low tide', and river / sea lamprey do not have sensitivity information or CLs on APIS. However, as mudflats are regularly inundated with water and lamprey use freshwater and marine habitats, 'mudflats and sandflats not covered by seawater at low tide' and river / sea lamprey are not considered sensitive to airborne air pollutants and have been screened out. This approach has previously been agreed with the EA and Natural Resources Wales (NRW) on submissions for other developments which have subsequently been approved.

4.2.2.6 Key impacts on river and sea lamprey include river pollution, engineering works that can create obstacles to upstream migration (e.g. dams, weirs) and destruction of their spawing gravels and other habitat[24]. As the River Trent will not be affected by the Project except for a slight increase in boat traffic movement, no potential effects on river or sea lamprey are predicted and disturbance to lamprey species was screened out of the assessment.

4.2.2.7 For the Humber Estuary SPA / Ramsar site and Thorne & Hatfield Moors SPA, acid deposition is not expected to have a negative effect on any of the qualifying bird species. In all cases, APIS confirmed that the birds' broad habitat types were not sensitive to acid deposition, or there were no expected negative effects on the species as a result of effects on the species' broad habitat type. However, a number of the qualifying bird species of the SPAs were sensitive to the potential effects of nitrogen deposition on their broad habitat types so the effects of nitrogen deposition were assessed further.

4.2.2.8 The degraded raised bog habitat at Thorne Moor SAC is sensitive to both nitrogen and acid deposition so the effects of these emissions were assessed further.

4.2.2.9 In summary, the sensitive qualifying interest habitats and species for each designated site that were taken forward for assessment of the effect of emissions to air are listed in Table 5.

[23] APIS notes that 'In most lowland rivers and burns, nitrogen inputs from catchment land-use, not deposition from the atmosphere, are likely to be much more significant'.

[24] Maitland, P.S. (2003) *Ecology of the River, Brook and Sea Lamprey.* Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Table 5: Sensitive Qualifying Interest Features

Designated Site	Qualifying Annex I Habitats and Annex II Species	Sensitive to nitrogen (APIS)?	Sensitive to acidity (APIS)?
Humber Estuary SAC / Ramsar	Estuaries	✓	×
	Atlantic salt meadows	✓	×
Humber Estuary Ramsar	Birds species including black tailed godwit & golden plover	✓	×
Humber Estuary SPA	Bird species including avocet, black tailed godwit, curlew, dark-bellied brent goose, golden plover, great bittern, little tern, marsh harrier & wigeon	✓	×
Thorne Moor SAC	Degraded raised bogs still capable of natural regeneration	✓	✓
Thorne & Hatfield Moors SPA	European nightjar	✓	×

4.3 Effects Considered in the Assessment

4.3.1.1 The potential effects on European sites due to the construction and / or operation of the Project considered in the assessment include:

- the effect of operational emissions to air;
- disturbance or displacement of qualifying interest bird species from the Humber Estuary Ramsar site;
- disturbance or displacement of qualifying interest bird species from the Humber Estuary SPA using functionally linked land;
- recreational disturbance;
- changes to water quality; and
- changes to air quality during construction.

4.3.1.2 Decommissioning activities will be similar in approach and scale to construction activities. Therefore the assessment of construction effects in this report will also be applicable to the decommissioning phase.

4.3.1.3 These potential effects are considered in more detail in the following sections.

4.4 Screening of Emissions to Air – Project Alone

4.4.1 Overview

4.4.1.1 This section summarises the predicted effects of the air pollutants from the Project alone on the European designated sites and whether “no likely

significant effect" can be concluded, or whether further assessment (i.e. AA) is required.

4.4.1.2 A summary of the PCs, and where necessary PECs, as a percentage of the critical levels / loads for each designated site is presented. For nutrient nitrogen and acid deposition, only the qualifying interest habitats and species that are sensitive to the effects of these emissions are listed Section 4.2.2). The air dispersion modelling results are described further in ES Chapter 5 Air Quality (**Document Reference 6.2.5**).

4.4.2 Effects of NO_x on European Sites

4.4.2.1 The predicted PCs for long-term (annual mean) and short-term (24 hour) NO_x are listed in Table 6.

4.4.2.2 At the Humber Estuary SAC / Ramsar and SPA, the long-term environmental standard was exceeded (annual PC was > 1% of the critical level), but the PEC, taking account of background levels, was well below 70% of the critical level. Therefore, the emissions from the Project alone were still considered to be insignificant according to the assessment criteria. Consequently, no likely significant effects on the Humber Estuary SAC, Ramsar site or the Humber Estuary SPA are expected as a result of annual NO_x emissions.

4.4.2.3 The PC was < 1% of the critical level (for annual mean) at Thorne Moor SAC and Thorne & Hatfield Moors SPA indicating that emissions of NO_x are insignificant at these sites.

4.4.2.4 For 24 hr NO_x, the data shows that the PC is > 10% of the critical level at the Humber Estuary SAC and Ramsar site, therefore effects cannot be screened out as insignificant and further assessment is required. Levels are insignificant (PC < 10% of the critical level) at the other European sites.

Table 6: Predicted PCs for NO_x and Percentages of Critical Levels

European Site	Baseline NO_x ($\mu g\ m^{-3}$)	Critical Level ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	PC as % of Critical Level	PEC as % of Critical Level
NO_x Annual Mean					
Humber Estuary SAC, Ramsar	13.5	30	2.0	6.8%	51.7%
Humber Estuary SPA	13.5	30	0.3	1.0%	45.9
Thorne Moor SAC	13.2	30	0.03	0.1%	-
Thorne & Hatfield Moors SPA	12.9	30	0.03	0.1%	-
NO_x 24hr					
Humber Estuary SAC, Ramsar	27.0	75	36.5	48.7%	N/A

European Site	Baseline NO_x ($\mu g\ m^{-3}$)	Critical Level ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	PC as % of Critical Level	PEC as % of Critical Level
Humber Estuary SPA	27.0	75	3.0	4.0%	N/A
Thorne Moor SAC	26.4	75	1.1	1.5%	N/A
Thorne & Hatfield Moors SPA	25.8	75	1.1	1.5%	N/A

The PC is considered to be an insignificant contribution where:

- For NO_x Annual Mean: PC < 1% of CL and / or PC > 1% but PEC < 70% of CL
- For NO_x 24hr: PC < 10% of CL (short term)

4.4.3 Effects of Ammonia on European Sites

4.4.3.1 The predicted PCs for ammonia (NH_3) are listed Table 7.

4.4.3.2 The critical levels used are those for vascular plants (3 $\mu g\ m^{-3}$) for all the European sites except for Thorne Moor SAC, where lichens are present and the more stringent critical level for lichen and bryophyte presence was used (1 $\mu g\ m^{-3}$).

4.4.3.3 Ammonia levels exceeded the percentage PC threshold of 1% and the PEC threshold of 70% of the critical level at the Humber Estuary SAC and Ramsar site so further assessment is required. Levels are insignificant (PC < 1% of the critical level) at the other European sites and no likely significant effects are expected as a result of emissions of ammonia.

Table 7: Predicted PCs for NH_3 and Percentages of Critical Levels

European Site	Baseline NH_3 ($\mu g\ m^{-3}$)	Critical Level ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	PC as % of Critical Level	PEC as % of Critical Level
Humber Estuary SAC, Ramsar	3.6	3	0.05	1.6%	120.9%
Humber Estuary SPA	3.6	3	0.02	0.7%	-
Thorne Moor SAC	2.6	1	0.002	0.2%	-
Thorne & Hatfield Moors SPA	3.5	3	0.002	0.1%	-

The PC is considered to be an insignificant contribution where:

- PC < 1% of CL and / or PC > 1% but PEC < 70% of CL

4.4.4 Effects of SO_2 on European Sites

4.4.4.1 The predicted PCs for SO_2 (annual) are listed in Table 8. As for ammonia, the more stringent critical level for lichen or bryophyte presence (10 $\mu g\ m^{-3}$ for SO_2) was used at Thorne Moor SAC only, with a critical load of 20 $\mu g\ m^{-}$

^{3} applied to all other sites. The PC did not exceed 1% of the critical level at any of the European sites and therefore emissions of SO_2 were considered insignificant. No likely significant effect on the European sites are predicted.

Table 8: Predicted PCs for SO_2 and Percentages of Critical Levels

European Site	Baseline SO_2 (µg m^{-3})	Critical Level (µg m^{-3})	PC (µg m^{-3})	PC as % of Critical Level
Humber Estuary SAC, Ramsar	7.5	20	0.1	0.7%
Humber Estuary SPA	7.5	20	0.1	0.3%
Thorne Moor SAC	1.3	10	0.01	0.1%
Thorne & Hatfield Moors SPA	1.6	20	0.01	0.03%

The PC is considered to be an insignificant contribution where:

- PC < 1% of CL and / or PC > 1% but PEC < 70% of CL

4.4.5 Effects of HF on European Sites

4.4.5.1 The predicted PCs for short-term hydrogen fluoride (HF) at the European sites are listed in Table 9. The PC was < 10% of the critical level for both weekly and 24 hr emissions (both considered to be short term). Therefore emissions of HF are considered to be insignificant and no likely significant effects on the European sites are expected.

Table 9: Predicted PCs for HF and Percentages of Critical Levels

European Site	Baseline HF (µg m^{-3})	Critical Level (µg m^{-3})	PC (µg m^{-3})	PC as % of Critical Level
HF Weekly				
Humber Estuary SAC, Ramsar	3.6	0.5	0.04	7.7%
Humber Estuary SPA	3.6	0.5	0.01	1.3%
Thorne Moor SAC	3.2	0.5	0.002	0.3%
Thorne & Hatfield Moors SPA	3.2	0.5	0.002	0.3%
HF 24hr				
Humber Estuary SAC, Ramsar	3.6	5	0.1	1.9%
Humber Estuary SPA	3.6	5	0.02	0.4%
Thorne Moor SAC	3.2	5	0.01	0.1%
Thorne & Hatfield Moors SPA	3.2	5	0.01	0.1%

The PC is considered to be an insignificant contribution where:

European Site	Baseline HF ($\mu g\ m^{-3}$)	Critical Level ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	PC as % of Critical Level

- PC < 10% of CL (short term)

4.4.6 Effects of Deposited Nitrogen on European Sites

4.4.6.1 The predicted PCs for deposited nitrogen are listed in Table 7. The PC exceeded 1% of the critical load and the PEC exceeded the 70% threshold for Atlantic saltmeadow (saltmarsh) and estuary habitat types at the Humber Estuary SAC / Ramsar site, therefore further assessment is required.

4.4.6.2 Contributions of nutrient nitrogen are insignificant (PC < 1% of the critical load) at all other European sites and no likely significant effects are expected.

4.4.7 Effects of Acid Deposition on European Sites

4.4.7.1 Thorne Moor SAC was the only European site with qualifying interest features located within 15 km of the Project that was identified as sensitive to acid deposition.

4.4.7.2 The predicted PCs for acid deposition at Thorne Moor SAC are listed in Table 11 The PC did not exceed 1% of the critical load and therefore the effects of acid deposition on the SAC were considered insignificant. No likely significant effects on Thorne Moor SAC are predicted.

Table 10: Predicted PCs for Deposited Nitrogen and Percentages of Critical Loads

European Site	Qualifying Interest Feature	Background Nitrogen Deposition (kg N /ha /yr)	Critical Load (CL) (kg N/ha /yr) (min)	PC (kg N /ha /yr)	PC as % of CL (min)	PEC as % of CL
Humber Estuary SAC, Ramsar	Atlantic salt meadows Estuaries	28.9	20	0.5	2.3%	146.8%
Humber Estuary SPA	Pioneer, low-mid and mid-upper saltmarshes supporting a wide range of wetland bird species. Low and medium altitude hay meadows – golden plover, curlew, ruff, wigeon, lapwing, teal, oystercatcher & redshank.	28.9	20	0.1	0.7%	-
	Rich fens supporting hen harrier, great bittern, marsh harrier	28.9	15	0.1	0.9%	-
Thorne Moor SAC	Degraded raised bogs still capable of natural regeneration	21.3	5	0.01	0.3%	-
Thorne & Hatfield Moors SPA	Coniferous woodland and dwarf shrub heath supporting European nightjar	46.2	5	0.01	0.3%	-

The PC is considered to be an insignificant contribution where:

- PC < 1% of CL and / or PC > 1% but PEC < 70% of CL

Table 11: Predicted PCs for Acid Deposition and Percentages of Critical Loads

European Site	Qualifying Interest Feature	Background Acid Deposition (keq ha-1 yr-1)		Critical Load (CL) (keq ha-1 yr-1)			PC (keq ha-1 yr-1)		PC as % of CL (min)
		S baseline	N baseline	CL max S	CL min N	CL max N	Total S	Total N	
Thorne Moor SAC	Degraded raised bogs still capable of natural regeneration	0.2	1.5	0.1	0.3	0.5	0.001	0.001	0.4%

The PC is considered to be an insignificant contribution where:

- PC < 1% of CL and / or PC > 1% but PEC < 70% of CL

4.5 Screening of Other Effects – Project Alone

4.5.1 Disturbance or Displacement of Qualifying Interest Birds from the Humber Estuary Ramsar site

4.5.1.1 The construction and operation of the Project will result in increased noise, artificial lighting and human disturbance. There will also be an increase in road and rail traffic, and increased vessel movement along the River Trent. This has the potential to lead to disturbance to, or displacement of, bird species from foraging or roosting habitats.

4.5.1.2 The Extended Phase 1 Habitat surveys established that there is little suitable habitat for qualifying interest bird species within the Order Limits. Habitats include intensively managed arable farmland with associated field drains and hedgerows which provide limited refuge or foraging habitat for the waterbirds listed under the Humber Estuary Ramsar or SPA designation (ES Chapter 10 Ecology and Nature Conservation) (**Document Reference 6.2.10**). The River Trent provides more suitable habitat adjacent to the Project, with the riverside vegetation dominated by reedbeds in this area.

4.5.1.3 The breeding,wintering and migratory bird survey results confirmed that the arable farmland habitat is not an important area for most waterbirds. During the breeding bird survey, no bird species from the Ramsar site were recorded. Only small numbers of waterbirds from the Humber Estuary Ramsar were recorded in the arable fields around the Project during the wintering and migratory bird surveys (such as teal, oystercatcher, lapwing, curlew and a single sighting of marsh harrier flying over arable fields). Slightly higher numbers of roosting golden plover were recorded on occasion (with a peak count of 82) within the Order Limits but the majority of observations were of low numbers of birds.

4.5.1.4 The wintering and migratory bird survey also found that the area of the River Trent adjacent to the Project did not support significant populations of most waterbirds, with only small numbers of birds recorded. A larger sized flock was recorded on only a few occasions.Aflock of approximately 50 lapwing were recorded in fields to the west of the River Trent (which will not be affected by the Project) on one survey visit. Golden plover were recorded in larger numbers in flight on one survey (a peak count of 290 birds were observed in flight over the River Trent) but all other observations of golden plover in flight or on land were in much lower numbers.

4.5.1.5 Only small numbers of waterbirds that are qualifying interest features of the Humber Estuary Ramsar designation were recorded. There is potential for disturbance to these birds during construction and operation of the Project, for example as a result of increased noise, lighting, traffic movements and human presence. However, birds using the local area are showing signs already of tolerance to some sources of disturbance, given the existing industrial estate present and regular agricultural activity. If small numbers

of birds are disturbed, there are large areas of estuarine and arable farmland habitats available in the local area to move to. Given this and the low numbers of qualifying feature bird species recorded, the effects of disturbance or displacement on birds from the Ramsar designation are not predicted to be significant.

4.5.2 Disturbance or Displacement of Qualifying Interest Birds from the Humber Estuary SPA on Functionally Linked Land

4.5.2.1 The Humber Estuary SPA lies 6.5 km to the north of the Project. However, there is the potential that mobile qualifying interest bird species from the SPA rely on land outwith the SPA boundary for foraging or roosting. Important areas for qualifying birds outside of the SPA designation which support the species in question are referred to as 'functionally linked land'.

4.5.2.2 As detailed in the previous section, the breeding and wintering bird surveys highlighted that the arable farmland habitat surrounding the Project is not an important area for waterbirds, with very low numbers of waterbirds recorded. During the wintering and migratory surveys, waterbird species were recorded in low numbers (such as teal, oystercatcher, lapwing, curlew, golden plover and a single sighting of marsh harrier). The only exception to this were occasional sightings of larger flocks of lapwing and golden plover(as detailed previously) and regular records of mallard, which were recorded in larger numbers (with a peak of 41 birds during the wintering survey and a peak of 45 birds during the migratory bird survey). Wintering mallard are a qualifying interest species of the Humber Estuary SPA but are not protected under the Ramsar designation. The mallards were mainly recorded in the water of the River Trent, on its banks or flying over the river, with small number of birds recorded in the adjacent fields. Mallard was the only qualifying interest species recorded on the majority of wintering and migratory bird survey visits rather than occasionally, and in significantly sized numbers throughout the survey visits to suggest that the location may be important for the species.

4.5.2.3 A recent NE commissioned report defines functionally linked land as 'areas of land occurring within 20 km of an SPA, that are regularly used by significant numbers of qualifying bird species'[25]. A 'significant number of birds' can be defined as 1% of the qualifying population of the SPA. The latest British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS) report lists the mallard population of the SPA as 1046 individuals (based on a five year average from 2015/16 to 2019/20)[26]. The wintering and migratory survey peak counts of 42 and 45 birds respectively would account for 4% of the SPA population. In total, peak counts of over 10 birds (i.e. over 1% of the SPA population) were recorded on approximately half of all wintering and migratory bird survey visits. Therefore, it has been assumed that the area of the River Trent and its immediate banks adjacent to the Project is functionally linked land for the Humber Estuary SPA and

[25] Bowland Ecology 2021. Identification of Functionally Linked Land supporting SPA waterbirds in the North West of England. NERC361. Natural England

[26] WeBS Report Online.

the potential effect on mallard from this area was assessed further in the AA.

4.5.3 Recreational Disturbance

4.5.3.1 The Project is committed to enabling public access and new cycleways and footpaths will be provided as part of the Project. The Project also includes the creation of a new wetland area adjacent to the River Trent, which will create new ecologically diverse wetland habitats (ES Chapter 3 The Project Description and Reasonable Alternatives) (**Document Reference 6.2.3**). The wetland will have informal paths and an associated Visitor Centre to encourage public access. The new wetlands area and its use by visitors and operational personnel has been considered as a potential source of impact in the assessment of recreational disturbance.

4.5.3.2 There is the potential for the increase in recreational use of the site to cause disturbance to qualifying interest bird species of the Humber Estuary Ramsar, or those using functionally linked land associated with the Humber Estuary SPA. However, bird species associated with the designated site have only been recorded in small numbers around the NLGEP site and River Trent, as detailed previously. The raised earth embankments around the River Trent provide some screening of activity to birds on the river. Given the small numbers of Humber Estuary SPA and Ramsar qualifying interest species present in the local area and their likely sensitivity to disturbance, any effects are likely to be temporary and localised. No likely significant effects on the functionally linked land associated with the Humber Estuary SPA, or the Humber Estuary Ramsar site are predicted.

4.5.4 Water Quality Impacts

4.5.4.1 The water quality of the River Trent (part of the Humber Estuary SAC / Ramsar site) will not be directly affected by the Project. The whole of the River Trent along the length of the Order Limits is lined with raised earth embankments which provide flood defence. There will be no abstractions to or discharges from the river. There will be no construction, operational or decommissioning interactions with the River Trent (as detailed in ES Chapter 9 Water Resources and Flood Risk, **Document Reference 6.2.9**).

4.5.4.2 The only potential pathway for impact on the Humber Estuary SAC / Ramsar is from surface water as the River Trent is downstream of the Project. In the absence of mitigation, the potential for contaminated surface water entering the watercourse and resulting in significant effects on the qualifying interest habitats or species supported by the River Trent cannot be excluded. Therefore, the potential effect on the Humber Estuary SAC / Ramsar was assessed further in the AA.

4.5.5 Air Quality during Construction

4.5.5.1 The potential effects on air quality during construction were also considered for the Humber Estuary SAC / Ramsar site. The Air Quality assessment concluded that the likely impacts of increased traffic emissions

during construction are negligible and were therefore not considered further (ES Chapter 5 Air Quality, **Document Reference 6.2.5**).

4.5.5.2 The River Trent section of the Humber Estuary SAC / Ramsar site is adjacent to the Project and within the zone where construction dust impacts may occur (ES Chapter 5 Air Quality, **Document Reference 6.2.5**). In the absence of mitigation, the potential for construction dust resulting in significant effects on the qualifying interest habitats or species of the European site cannot be excluded. Therefore the potential effect of construction dust on the Humber Estuary SAC / Ramsar was assessed in the AA.

4.5.6 Screening Assessment Summary

4.5.6.1 The PCs for all of the pollutant types at Thorne Moor SAC and Thorne & Hatfield Moors SPA are predicted to be insignificant. Therefore, no likely significant effects on these European sites are predicted and no further assessment is required.

4.5.6.2 The screening assessment could not rule out the potential for significant effects at the Humber Estuary SAC / Ramsar site for the effects of operational emissions to air (NO_x (24 hr), ammonia and nitrogen deposition (for Atlantic salt meadows and estuary habitat types)), surface water quality and construction dust. In addition, potential disturbance to mallard using functionally linked land associated with the Humber Estuary SPA could not be screened out.

4.5.6.3 Therefore further assessment was required for the Humber Estuary SAC / Ramsar and the Humber Estuary SPA as part of the AA.

4.6 In-combination Effects – Screening

4.6.1 Approach to Screening

4.6.1.1 The ES sets out the approach to assessing the cumulative effects of the Project in Chapter 18 Cumulative Assessment (**Document Reference 6.2.18**). The same approach has been used to identify plans and projects which may have an in-combination effect on European sites for this HRA. Other developments considered in the assessment included those which are under construction, permitted applications not yet implemented and submitted applications not yet determined.

4.6.1.2 The assessment applied a proportionate approach in identifying other proposed developments that could contribute to impacts on the same receptors as the Project. The spatial scope of each planning category considered is summarised in Table 12 below. The search area was determined by the largest distance at which the Project could potentially have in-combination effects. The key search areas for the HRA in-combination assessment were:

- In terms of emissions to air, it was considered that only developments with significant combustion emissions had the potential to have an effect in-combination with this Project. For air quality impacts on SAC, SPA and Ramsar sites the search area for other developments was a 15 km radius around the main emission source at the ERF, and then a further 15 km radius around European sites that fell within the initial 15 km radius, as requested by Natural England during consultation (see Section 2.6). For the extensive Humber Estuary SAC / Ramsar site, the search area extended 15 km only from the areas of the designated site that fell within the original 15 km search area; and
- A conservative 2 km search area around the Project Order Limits was applied for construction and operational disturbance or other indirect local effects, plus a further 2 km buffer around those parts of the Humber Estuary SAC / Ramsar falling within the initial 2 km search area.

Table 12: Planning Categories Scale and Spatial Scopes

Category	Spatial Scope
Power generation projects or projects with significant combustion emissions a. NSIP b. Section 36 (including variations) of the Electricity Act c. Town and Country Planning Act (combustion projects only that constituted EIA development under the Town and Country Planning (EIA) Regulations 2017 and required HRA to screening stage at least	15 km from main emission source at the ERF, plus a further 15 km from each European site (SAC / SPA / Ramsar) falling within the initial 15 km
NSIP, Section 36 (including variations), Section 37 of the Electricity Act and Town and Country Planning Act: for projects which, by virtue of their potential to affect (e.g. through disturbance) a European protected site, were screened in to undertake an EIA under the Town and Country Planning (EIA) Regulations 2017	0 to 2 km from the Order Limits, plus a further 2 km from the parts of European sites falling within the initial 2 km zone

4.6.1.3 The cumulative assessment established a long list of 232 developments to be considered, which was then screened to identify a shortlist of developments relevant for the HRA. The full process is detailed in Chapter 18 Cumulative Assessment (**Document Reference 6.2.18**). The screening considered temporal considerations (e.g. whether the construction of other development could overlap in time with the Project construction phase). As a worst-case approach, it was assumed that there will be overlapping operational phases for all the other developments with the operational phase of the Project. Very small scale developments such as household extensions were screened out. It also considered technical considerations, such as the likely zone of influence (ZoI) for each impact type. In terms of

HRA, the main impacts (and their zones of influence) considered are listed in Table 13.

Table 13: Project Impacts (and their Zones of Influence) with Potential to Contribute to Cumulative Effects on European Sites

Topic	Potential Impacts	Zone of Influence
HRA: construction	During construction, potential cumulative disturbance effects could occur with other developments being constructed in close proximity.	A conservative ZoI was applied for European sites, comprising up to 2 km from the Order Limits, plus 2 km from the parts of European sites falling within the initial 2 km zone. This zone was considered for impacts such as construction dust and disturbance to qualifying interest species.
HRA: operation	During operation, the key consideration will be the potential combined effect of emissions to atmosphere (from the Project and other combustion processes) and subsequent pollutant deposition on designated sites.	15 km, plus a further 15 km from each European site falling within the initial 15 km zone. Other developments considered are those that are likely to include a significant combustion process. 2 km for local wildlife sites.
	Some activities associated with operation could contribute to cumulative effects with other developments in close proximity.	Up to 2 km from the Order Limits, plus 2 km from the parts of European sites falling within the initial 2 km zone.

4.6.1.4 The extents of these ZoI are shown on Figure 5 and Figure 6 along with the developments identified within them. Any developments shown on the Figures but not short-listed in Table 14 were not considered to have effects that should be considered for the HRA in-combination screening.

4.6.1.5 Consideration of developments with significant operational emissions, a review of other developments with large combustion sources not yet operating, but likely to operate concurrently with the Project, identified the following:

- Keadby 2 (within 15 km);
- Keadby 3 (within 15 km);
- An Energy Recovery Facility at Doncaster (within 15 km of European sites that are within 15 km of the Project); and
- An Energy Centre in Hull (within 15 km of European sites that are within 15 km of the Project).

4.6.1.6 The locations of these other developments are shown in Figure 5. Several other developments recently approved were also identified but were screened out of the in-combination effects assessment for the following reasons:

- Eggborough (within 15 km of European sites that are within 15 km of the Project) is a CCGT to replace a former coal fired generation station

of similar size operating until 2018 and assumed to have been contributing to the baseline measurements made in recent years. This development has been screened out as effectively displacing the emissions of a previous similar-sized emitter.

- West Burton (within 15 km of European sites that are within 15 km of the Project) is a 299 MW gas-fired plant which will replace a much larger coal-fired plant scheduled to operate until September 2022. This development has been screened out as effectively displacing the emissions of a larger-sized emitter.
- Drax Repower (within 15 km of European sites that are within 15 km of the Project) is replacing the remaining two coal-fired units with gas turbines[27]. This development has been screened out as effectively displacing the emissions of a previous similar-sized emitter.

4.6.1.7 On further assessment and review of the planning applications for the Energy Recovery Facility at Doncaster (see BH EnergyGap LLP, 2020)[28] and the Energy Centre in Hull (Energy Works (Hull) Ltd, 2011)[29] it was apparent that each development had assessed its air quality effects to a distance of 10 km from their respective locations. It is reasonable to assume that no air quality impacts were predicted beyond these distances. The Energy Recovery Facility at Doncaster and the Energy Centre in Hull are approximately 13.3 km and 13.9 km away respectively from any parts of European sites that are within 15 km of the Project. On this basis these other developments were screened out of the in-combination effects assessment.

4.6.1.8 The above screening process left the Keadby 2 and Keadby 3 developments for consideration in the in-combination effects assessment. It should further be noted that Keadby 1 gas-fired power station will cease operating before Keadby 3 is commissioned.

[27] Currently it appears that the Drax Repower project in the form of gas turbines will not proceed and a likely scenario is the existing coal-fired generation will be replace by biomass. Whatever the outcome, in emission terms it will still be a case of effectively displacing the emissions of a previous similar-sized emitter.

[28] BH EnergyGap LLP (2020) Sandall Stones Road, Doncaster – Environmental Statement Volume 1 Chapter 5 Air Quality

[29] Energy Works (Hull) Ltd (2011) Environmental Statement - Air Quality and Odour and Environmental Statement Addendum for an Energy Works on three adjacent parcels of land in Hull (Application 11/00615/CM)

Table 14: Short List of Other Developments for Consideration in the HRA

ID	Application Reference	Description of Other Development	Location in relation to Order Limits	Overlap in temporal scope
84	PA/2015/0628	Hybrid application for full planning permission for new road and footpaths, informal areas of open space, parklands, play areas and new wildlife habitats, attenuation ponds, recreational lakes, and wetlands community; and outline planning permission with all matters reserved for non-residential institutions (Use Classes D1 and D2), leisure facilities (Use Classes A1 and A3) and storage (Use Class B8).	Within 100 m	Construction
85	PA/2015/0396	Outline planning permission for the development of up to 2500 new homes including a village centre (Use Classes A1, A2, A3, A4, A5, B1 and D1), a health care facility (Use Class D1), community facilities (Use Class D1), a 3 form of entry primary school (Use Class D1), new roads and footpaths, informal areas of open space, play spaces and new wildlife habitats, water bodies and wetlands with all matters reserved for subsequent approval.	Within 100 m	Construction
86	PA/2015/0627	Planning permission for highway works to deliver the new terminating junction to the M181 motorway (due to the de-trunked section of the highway to the north and south of the terminating junction) and the development of the eastern and western sections of the east west link road connecting to the B1450 Burringham Road.	Within 100 m	Construction
21(2)	PA/2019/1461	Planning permission to site an array of ground mounted photovoltaic solar collectors including associated infrastructure.	Within 100 m	Construction
83	PA/2020/2049	Planning permission for the construction of 163 two, three and four bedroomed, 2 storey traditional residential homes with associated garages and access infrastructure.	Within 100 m	Construction
10(2)	PA/2018/1388	Planning permission to re-develop existing football stadium to deliver 11,000 capacity football stadium (Use Class D2); cafe/bar (Use Class A3/4); commercial space (mixed use); club shop (Use Class A1); site access, car parking and associated infrastructure.	Within 100 m	Construction
11(2)	PA/2018/1389	Outline application for the erection of one hundred and sixty apartments with associated works and some matters reserved.	Within 2 km	Construction
16(4)	PA/2018/2140	Planning permission for the installation of a renewable led energy scheme comprising ground mounted photovoltaic solar arrays and battery-based electricity storage containers together with substations; transformer stations; access; internal access track.	Within 1 km	Construction

ID	Application Reference	Description of Other Development	Location in relation to Order Limits	Overlap in temporal scope
17(2)	PA/2018/2186	Outline planning permission for 36 dwellings including new access road and adoptable sewage pumping station (appearance, landscaping, layout and scale reserved for subsequent approval).	Within 1 km	Construction
180	PA/2021/1069	Planning permission to carry out a flood mitigation scheme including the creation of five surface water storage areas and associated works.	Within 2 km	Construction
193	PA/2021/672	Outline planning permission to erect 302 dwellings, to include remediation of the site and means of access as a matter not reserved for subsequent consideration.	Within 1 km	Construction
200	PA/2021/1069	Planning permission to carry out a flood mitigation scheme including the creation of five surface water storage areas and associated works.	Within 2 km	Construction
4(1)	PA/2017/1386	Planning permission for highway works to deliver a new terminating junction to the M181 motorway comprising a new at-grade roundabout to access the B1450 Burringham Road from the M181, new B1450 side roads and realignment of the existing B1450, two new.	Within 100 m	Construction
49(1)	PA/2017/1977	Planning permission for the construction of a Flood Defence Scheme comprising of sheet piling along the right bank of the River Trent; the placing of scour protection along the right bank of the River Trent; localised property protection.	Within 2 km	Construction
8(4)	PA/2018/1060	Planning permission to erect a precast concrete manufacturing facility along with external storage areas and associated infrastructure.	Within 1 km	Construction
N1	Section 36 Variation Consent	Keadby 2 Power Station Project. 910 MW Combined gas fired generating station (CCGT).	Within 7.5 km	Operation
N2	Planning Inspectorate Ref: EN010114	Keadby 3 Low Carbon Gas Power Station Project. A combined cycle gas turbine (CCGT) power station, comprising a CCGT unit with a capacity of up to 910 megawatts (MW) electrical output (gross), carbon capture and compression plant, a CO2 export pipeline connection, and associated development.	Within 7.5 km	Operation

4.6.2 Potential for In-combination Effects

4.6.2.1 No direct impacts from the Project on European sites have been identified as part of the HRA and therefore the in-combination assessment focussed on potential indirect impacts identified during the screening stage of the Project.

4.6.2.2 The air quality assessment concluded that there will be no significant cumulative effects from construction dust. Additionally, surface water interactions for each development will be fully managed under the relevant permitting process and no significant cumulative effects are expected as set out in ES Chapter 18 Cumulative Assessment (**Document Reference 6.2.18**). Consequently the potential for in-combination effects as a result of construction dust or surface water interactions were screened out of the assessment.

4.6.2.3 Therefore the potential for in-combination effects with other developments was considered for:

- the effect of operational emissions to air;
- disturbance or displacement of qualifying interest bird species from the Humber Estuary Ramsar site; and
- disturbance or displacement of qualifying interest bird species from the Humber Estuary SPA using functionally linked land.

4.6.3 Potential for In-combination Effects - Operational Emissions to Air

4.6.3.1 For operational emissions to air, two projects were identified that had the potential for in-combination effects: Keadby 2 Power Station Project and Keadby 3 Low Carbon Gas Power Station Project (see Figure 5). The potential in-combination effects of these developments are considered in the following sections.

Project Overview: Keadby 2 and Keadby 3

4.6.3.2 The Keadby 2 Project is a combined cycle gas turbine (CCGT) nearing completion of construction. It received its Environmental Permit to operate in November 2020. Information to support the assessment of in-combination effects is drawn from Keadby Power Station - Environmental Permit Variation Application, Air Quality Impact Assessment and Habitat Regulations Assessment, 29 November 2019 (SSE, 2019)[30].

4.6.3.3 The Keadby 3 Low Carbon Gas Power Station Project is an NSIP for which the DCO application was accepted in June 2021. In its ES, Keadby 3

[30] SSE (2019) Keadby Power Station - Environmental Permit Variation Application, Air Quality Impact Assessment and Habitat Regulations Assessment, 29 November 2019

assessed air quality effects on protected sites (SSE, 2021a)[31] for the proposed development alone and in-combination with other developments (SSE, 2021b)[32]. In doing so it considered Keadby 2 as part of the baseline and did this by modelling Keadby 2 emissions and adding them to the current baseline. The assessment of Keadby 3 concluded that the Project could potentially have in-combination effects with Keadby 3 but since the Project was at an early stage in the application process insufficient data were available to make an assessment and that the onus would therefore fall on the Project to assess in-combination effects with Keadby 3.

4.6.3.4 Based on a review of the information provided in the Keadby 2 Environmental Permit application (SSE, 2019) and the Keadby 3 ES (SSE, 2021a) the following conclusions on in-combination effects can be made for the pollutants of interest, namely NO_x, ammonia (NH_3), nutrient nitrogen deposition and acid deposition. It should be noted that the assessments of all three sets of emissions must be considered worst case for several reasons, including: (a) the values referred to are generally the highest that occur anywhere within a protected site and will not be coincident for all three projects; (b) predictions are usually from the worst-case year for meteorological data input to the dispersion model; and (c) predictions are based on a worst-case operating hours scenario.

Emissions of NO_x (annual average and 24 hours)

4.6.3.5 For annual average NO_x, the Keadby 2 and 3 assessments predict contributions at the Humber Estuary SAC and Ramsar site of 2.9% and 1.6% of the critical level respectively. The Project also makes a contribution of 6.8% of the critical level at these sites. For the Humber Estuary SPA, the Keadby 2 and 3 assessments predict contributions of 0.6% and 0.4% respectively, and the Project makes a contribution of 1.0% of the critical level. Contributions of annual NO_x were substantially lower at Thorne Moor SAC / Thorne & Hatfield Moors SPA (with contributions of 0.1%, 0.2% and 0.2% of the critical level predicted for the Project, Keadby 2 and Keadby 3[33] respectively).

4.6.3.6 It should be noted that these contributions will not coincide at the same locations within these European sites. More importantly, there is substantial headroom before the in-combination predicted environmental concentration (i.e. baseline, plus Keadby 2, Keadby 3 and the Project) meets and / or exceeds 70% the critical level (i.e. the threshold guideline used to indicate a need for further assessment, if it is exceeded). Therefore no in-combination effects are predicted from Annual Average NO_x concentrations. Regarding short-term NO_x concentrations these cannot, for reasons of meteorological conditions, simultaneously affect the same protected site (or part thereof) and so are not considered further.

[31] SSE (2021a) The Keadby 3 Low Carbon Gas Power Station Project, Document Ref: 6.3, Environmental Statement Volume II - Appendix 8B: Air Quality - Operational Phase

[32] SSE (2021b) The Keadby 3 Low Carbon Gas Power Station Project, Document Ref: 5.12, Habitats Regulations Assessment Screening Report

[33] The NO_x contribution for Keadby 3 refers to Thorne Moor SAC only as contributions for Thorne & Hatfield Moors SPA were not presented.

Ammonia

4.6.3.7 Keadby 2 and 3 assessments predict process contributions of ammonia of 3.2% and 0.5% respectively of the critical level at Humber Estuary SAC and Ramsar site. The Project is predicted to make a process contribution of 1.6% of the critical level at Humber Estuary SAC and Ramsar site. For the Humber Estuary SPA, the Keadby 2 and 3 assessments predict contributions of 0.6% and 0.1% respectively, and the Project makes a process contribution of 0.7% of the critical level.

4.6.3.8 At Thorne Moor SAC, ammonia contributions from the Project, Keadby 2 and Keadby 3 are predicted as 0.2%, 0.7% and 0.2% of the critical level respectively. Thorne & Hatfield Moors SPA has similar contributions at 0.1% of the critical level for the Project and 0.6% of the critical level for Keadby 2 (no data for Keadby 3).

4.6.3.9 In-combination with those from Keadby 2 and 3, there is a need for further assessment of the effects of ammonia on the Humber Estuary SAC, SPA and Ramsar site, Thorne Moor SAC and Thorne & Hatfield Moors SPA.

Nitrogen Deposition

4.6.3.10 The Keadby 2 assessment predicts a contribution of nutrient nitrogen of 2.0 to 2.9% of the critical load at Humber Estuary SAC and Ramsar site, and Keadby 3 assessment predicts a contribution of 0.7%. The Project is predicted to make a contribution of 2.3% of the critical load at Humber Estuary SAC and Ramsar site. For the Humber Estuary SPA, Keadby 2 predicts contributions of 0.4 – 0.8% of the critical load, Keadby 3 predicts a contribution of 0.2%, and the Project predicts contributions of 0.7 – 0.9% of the critical load.

4.6.3.11 At Thorne Moor SAC, nitrogen deposition from the Project, Keadby 2 and Keadby 3 are predicted as 0.3%, 0.8% and 0.2% of the critical load respectively. At Thorne & Hatfield Moors SPA, contributions are 0.3% of the critical load for the Project and 0.4% of the critical load for Keadby 2 (no data for Keadby 3).

4.6.3.12 In-combination with those of Keadby 2 and 3, there is a need for further assessment of the effects of nitrogen deposition on the Humber Estuary SAC, SPA and Ramsar site, Thorne Moor SAC and Thorne & Hatfield Moors SPA.

Acid Deposition

4.6.3.13 Individually the Project, Keadby 2 and Keadby 3 predict that the effects on acid deposition were insignificant at Thorne Moor SAC (the only European site which is sensitive to the effects of acid deposition in this assessment). Keadby 3 predicted no appreciable contribution of acid deposition on Thorne Moor SAC (0.0% of the critical load). However, in-combination the combined emissions from the Project and Keadby 2 may equal or exceed the 1% of the critical load threshold, with contributions of 0.4% and

0.6% of the critical load respectively. Further consideration has been given to acid deposition based on the above and the already high background levels of acid deposition at Thorne Moor SAC.

Conclusion

4.6.3.14 As there is potential for the operational phases of these projects to coincide with that of the Project, the potential for likely significant effects on European sites could not be excluded and further assessment was required as part of the AA (see Section 5.5).

4.6.4 Potential for In-combination Effects - Disturbance or Displacement of Qualifying Interest Bird Species

4.6.4.1 The location of other projects in the vicinity of the Project was considered in relation to potential in-combination effects of disturbance or displacement of birds from the Humber Estuary Ramsar site and Humber Estuary SPA (through disturbance to mallard on the River Trent and its immediately adjacent banks, which is considered functionally linked land for mallard protected under the SPA designation).

4.6.4.2 Fifteen developments were identified within 2 km of the Project, which are mostly associated with the existing industrial estate and nearby residential areas (see Figure 6). While there will be some localised disturbance to local bird populations, all but one of the developments are over 1 km from the Humber Estuary Ramsar designation and the potential for in-combination disturbance effects is low. No likely significant in-combination disturbance effects on the Humber Estuary Ramsar bird populations are expected.

4.6.4.3 As illustrated on Figure 6, no new developments with the potential for disturbance effects on birds were identified within the extended 2 km zone up the River Trent. Only one development was identified close to the River Trent, which was a flood defence scheme which could cause disturbance during construction. However, this development is situated over 4 km south of the stretch of the River Trent which will be affected by disturbance from the Project, and also almost 1 km outside of the Ramsar boundary. At this distance, in-combination effects are considered unlikely.

5. APPROPRIATE ASSESSMENT

5.1 Introduction

5.1.1.1 The HRA screening identified that an Appropriate Assessment (AA) was required for the effects of:

- NO_x (24 hour), ammonia and deposited nitrogen on the Humber Estuary SAC / Ramsar site;
- surface water quality on the Humber Estuary SAC / Ramsar site;
- construction dust on the Humber Estuary SAC / Ramsar site; and
- potential disturbance to mallard using functionally linked land associated with the Humber Estuary SPA.

5.1.1.2 This section assesses the impacts of the Project on the relevant qualifying interest features of each site. Contour plots have been produced to assist with the assessment of the potential effects of emissions to air, which illustrate the dispersion extent and concentrations of the pollutants as a percentage of the PC. The aim of the AA was to identify whether no adverse effect on the integrity of the European sites can be concluded, or whether adverse effects on the integrity of the European sites will result.

5.1.2 Drone Survey

5.1.2.1 As saltmarsh habitat was a key consideration in the AA, a drone survey was undertaken in June 2020 to remotely map the habitats along the length of the River Trent up and downstream from the Project site. Ground truthing of the data has not yet been undertaken so the results should be viewed as indicative rather than definite.

5.1.2.2 Figure 7 provides a comparison of the drone survey results and the Natural England Priority Habitat Inventory Dataset from Defra's MAGIC map website. The drone survey results indicated that the majority of the habitat lining the River Trent was reedbed with intermingled small areas of upper saltmarsh (represented as 'reedbed' on the map). While the NE dataset categorises it as saltmarsh, NEs supplementary advice on the Humber Estuary SAC saltmarsh habitat also suggests that reedbed is widespread. The advice notes that the tidal marsh community is dominated by Phragmites australis (common reed) and *Bulboschoenus maritimus* swamp (sea club-rush), along with *Elymus repens* (couch grass) saltmarsh community. These reedbed-dominated habitats account for more than 50% of the total tidal vegetation in the inner estuary down to the King George V Bridge at Gunness (which lies south of the Project site). The Environment Agency (EA) dataset on saltmarsh extent & zonation also shows that reedbed is the dominant habitat type along the River Trent, with small areas of fringing upper saltmarsh[34].

[34] Environment Agency Dataset: Saltmarsh Extent & Zonation.

5.1.2.3 Therefore, it is concluded that reedbed is more common along the River Trent than the MAGIC dataset shows and it will be assumed for the assessment that a mosaic of reedbed and upper saltmarsh habitat exists in these areas. The EA dataset of saltmarsh extent was used for the contour maps as the most up to date official information source.

5.2 Humber Estuary SAC / Ramsar

5.2.1 Effects of NOx

5.2.1.1 The PC for daily (24 hour) NO_x at the Humber Estuary SAC / Ramsar site exceeded the 10% threshold at 48.7% of the critical level. Daily (24 hour) NO_x is a measure of short-term peaks in emissions over the course of a day. These short-term emissions are less likely to have a significant impact on vegetation.

5.2.1.2 The Institute of Air Quality Management (IAQM) guide to the assessment of air quality impacts on designated nature conservation sites[35] notes that long term (annual mean) concentration of NO_x is the most relevant for its impacts on vegetation as the effects are additive in nature over months and years. The effects of long term NO_x was assessed as insignificant for the Humber Estuary SAC / Ramsar site in the HRA screening.

5.2.1.3 A contour plot (Figure 8) was produced to illustrate the main areas where 24hr NO_x was predicted to exceed the 10% threshold of the critical level. The contour plot shows that 9.4 ha of reedbed and 2.8 ha of upper saltmarsh habitat is affected along the Humber Estuary SAC / Ramsar site, extending up and downstream of the stack locations. Emission levels are only slightly over the 10% threshold over approximately half of this area, with a peak rising up to 48.7% of the critical level on the section of the River Trent adjacent to Flixborough Industrial Estate (where reedbed is dominant). Qualifying interest habitats in this area are limited to the small scattered areas of upper saltmarsh. The dominant habitat present is reedbed which is not a qualifying interest feature for either designated site.

5.2.1.4 The exceedance of the 10% threshold of the critical level will be of a short term nature which is less damaging to habitats, and will occur in an area with very little qualifying interest habitat. 9.4 ha of reedbed (which equates to 1% of reedbed extent within the SAC / Ramsar) and 2.8 ha of upper saltmarsh (0.3% of saltmarsh extent within the designated site) are within the exceedance zone but a much smaller part of this area (adjacent to Flixborough Industrial Estate) will actually experience the peak levels of emissions. Background levels of NO_x are low (well below the critical level for NO_x) which suggests that the saltmarsh could accommodate small increases in NO_x without adverse effects. Given the very small area of effect, its short term nature and the lack of qualifying interest habitats in this location, the effect of 24hr NO_x is not expected to be significant or negatively affect the conservation objectives of the Humber Estuary

[35] Holman et al (2019). A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.0, Institute of Air Quality Management, London.

SAC/Ramsar. It is concluded that there will be no adverse effect on site integrity.

5.2.2 Effects of Ammonia

5.2.2.1 The PC for ammonia at the Humber Estuary SAC / Ramsar site marginally exceeded the 1% threshold at 1.6% of the critical level. The PEC was also exceeded (120.9% of the critical level) due to high background levels of ammonia (predominantly due to agricultural sources) in the local area.

5.2.2.2 A contour plot (Figure 9) was produced to illustrate the main locations where ammonia was predicted to exceed the 1% threshold. This plot shows that the areas of the Humber Estuary SAC / Ramsar site affected by an exceedance of the 1% threshold are extremely limited. One small section of the River Trent lies within the 1% critical level contour line south of Flixborough Industrial Estate, where the PCs are predicted to reach between 1 and 1.6% of the critical level (i.e. only marginally over the 1% exceedance threshold). This area is dominated by reedbed habitat. There is one further area north of the industrial estate where the 1% contour line just skims the edge of the River Trent.

5.2.2.3 As detailed above, qualifying interest habitats in this area are limited, with reedbed dominating the riverside vegetation. It is possible that there are small areas of saltmarsh (a qualifying interest habitat) alongside this stretch of the River Trent but these would be small, marginal areas of habitat. The EA dataset suggests that 3.7 ha of reedbed vegetation (0.4% of the total extent of reedbed across the SAC / Ramsar) and 0.3 ha of upper saltmarsh (0.03% of the total extent of saltmarsh) will be affected.

5.2.2.4 Given the very small areas of the River Trent affected, and the marginal exceedance of the 1% threshold, it is considered unlikely that the exceedance of ammonia will result in any significant effects. The conservation objectives of the Humber Estuary SAC will not be affected and no adverse effect on site integrity is expected.

5.2.3 Effects of Deposited Nitrogen

5.2.3.1 The effects of deposited nitrogen were assessed further for the Humber Estuary SAC / Ramsar site, in relation to Atlantic saltmeadow (saltmarsh) and estuary habitats.

5.2.3.2 The PC for deposited nitrogen at the Humber Estuary SAC / Ramsar site exceeded the 1% threshold (2.3% of the critical load) and the PEC exceeded the 70% threshold (146.8% of the critical load) for Atlantic saltmeadow (saltmarsh) and estuary habitat types, hence the site was taken forwards for further consideration. For the estuary habitat type, the underlying sensitive habitat assessed was also saltmarsh. Background levels of nutrient nitrogen are high, predominantly due to agricultural practices which led to the exceedance of PEC.

5.2.3.3 The contour plot for the Humber Estuary SAC / Ramsar site (Figure 10) shows that the areas of the designated site affected by an exceedance of the 1% threshold are extremely localised, mainly affecting short lengths of the River Trent directly adjacent to the Project (which are almost exactly the same locations as those affected in the ammonia contour plot). In total, 4.4 ha of reedbed and 1.2 ha of upper saltmarsh vegetation is located within the 1% critical load contour line, which equates to 0.4% and 0.1% of the total areas of these habitats across the SAC / Ramsar respectively.

5.2.3.4 Therefore, Figure 10 illustrates that a combination of reedbed and upper saltmarsh will be affected. Even if all of the habitat was saltmarsh (a qualifying feature of the Humber Estuary SAC / Ramsar), the very small areas of the River Trent affected, the localised areas of effect (the peak of 2.3% of the critical load is restricted to one location immediately adjacent to Flixborough Industrial Estate) and the fact that the majority of the area is affected by contours only marginally over the 1% exceedance threshold means that it is considered unlikely that there will be any significant effects on the saltmarsh habitat. The conservation objectives of the Humber Estuary SAC / Ramsar will not be affected and no adverse effect on site integrity is expected.

5.2.4 Surface Water Quality

5.2.4.1 The HRA screening identified that, in the absence of mitigation, there was potential for the Humber Estuary SAC / Ramsar site to be adversely affected by contaminated surface water runoff into the River Trent.

5.2.4.2 The River Trent is downstream of the Project and surface water interactions from the Project (e.g. through local drains and ditches) will ultimately run in to the river. However, industry best practice techniques will be followed for all surface water crossings and interactions (such as the crossing of drains and agricultural ditches within the Order Limits) which is expected to result in negligible impacts on local water resources (as detailed in Chapter 9 Water Resources and Flood Risk, **Document Reference 6.2.9**). Therefore, it is reasonably expected that any effects further downstream at the River Trent would also be negligible. Therefore no likely significant effect on water quality is expected. No adverse effect on the site integrity of the Humber Estuary SAC / Ramsar site is expected.

5.2.5 Construction Dust

5.2.5.1 In the absence of mitigation, the HRA screening identified the potential for construction dust impacts on the qualifying interest habitats or species of the Humber Estuary SAC / Ramsar site.

5.2.5.2 With embedded, standard best practice measures in place, the impacts of construction dust were predicted to be of negligible or at worst, minor significance in the air quality assessment (see Chapter 5 Air Quality, **Document Reference 6.2.5**). The nearby habitats of the Humber Estuary SAC / Ramsar that could be affected by dust are reedbeds and small areas of saltmarsh lining the River Trent. The existing port (Flixborough Wharf)

lies between the river and construction work to the north but there are some areas to the south where work will be very close to the River Trent (e.g. the railway reinstatement). Any increased dust at these locations would be a localised and small scale impact on these habitats which is not predicted to be significant. Therefore, no adverse effect on the site integrity of the Humber Estuary SAC / Ramsar site is expected.

5.3 Humber Estuary SPA

5.3.1 Disturbance to Functionally Linked Land

5.3.1.1 The effects of potential disturbance to wintering mallard using the River Trent were also assessed further, as surveys established that the river and its immediately adjacent banks could be classed as functionally linked land used by mallards outside of the Humber Estuary SPA boundary.

5.3.1.2 Increased vessel movement has the potential to cause disturbance to mallard using the River Trent and its immediately adjacent banks. Freight transport by river during construction (2023 – 2028) would mainly comprise bringing imported fill to the site and is expected to result in between 4 and 16 additional vessel movements at Flixborough Wharf per month, with a maximum total of 80 vessel movements per year between 2023 and 2028 (see Chapter 13 Traffic and Transport, **Document Reference 6.2.13**). Therefore, there would be an estimated 4 extra vessels per week at peak in addition to the approximate one vessel per day currently. Freight transport by river during the operational phase is estimated to result in 580 additional vessel movements at Flixborough Wharf per year. Compared to the 305 vessel movements in 2019, this is an increase of almost 200% and nearly 50 additional vessel movements per month. This increased movement would result in approximately 2 – 4 vessel movements per day (based on 360 or 240 days per annum scenarios), in comparison to approximately one vessel per day previously.

5.3.1.3 Mallard using the River Trent and its immediately adjacent banks will be habituated already to the movement of vessels on the water currently and it is not expected that a small increase in boat movements per day would create a significant disturbance effect. The increase in vessel movements is very small in the construction phase (a 6 year period), which will allow habituation to small increases in vessel movements before the operational phase of the Project. Mallard are also a species that are often tolerant of humans and not particularly sensitive to disturbance[36].

5.3.1.4 The construction and operation of the Project will result also in increased noise, artificial lighting, traffic and human disturbance which could lead to disturbance or displacement of birds. However, the mallard populations are highly mobile and there are extensive areas of similar habitat in the local area which any displaced birds could move in to. The raised earth embankments around the River Trent also provide some screening of

[36] Woodward, I. D., Calbrade, N. A. and Holt, C.A. (2015) Humber Estuary Bird Decline Investigation 2014. BTO Research Report No. 668.

activity to birds on the river and its immediately adjacent banks. The existing industrial location of the site means that birds will be habituated to some disturbance already, and surveys have confirmed that only low numbers of birds are present. Therefore the effect of disturbance such as noise, lighting or traffic on mallard associated with the Humber Estuary SPA would be low. The majority of the SPA mallard population will be situated far from the Project around the main Humber Estuary and any short term and small scale effects along a short section of the River Trent are expected to be negligible. Therefore no adverse effect on the site integrity of the Humber Estuary SPA is expected.

5.4 Summary of Appropriate Assessment

5.4.1.1 The background levels of ammonia and nutrient nitrogen around the Humber Estuary are already high (exceeding the critical level or load), largely as a result of agricultural practices. This means that there is little capacity for increased PC levels in the air quality modelling which has flagged up potential exceedances.

5.4.1.2 However, by looking closer at habitat locations and contour plots illustrating where the qualifying interest features and main areas of effect are likely to be, it was possible to rule out any potential significant effects as a result of the Project. The AA concluded that there will be no adverse effects on site integrity at the Humber Estuary SAC / Ramsar site in terms of NO_x (24 hour), ammonia and deposited nitrogen (for saltmarsh habitats).

5.4.1.3 It is also worth giving consideration to recent and on-going trends in the baseline emissions and concentrations of the pollutants of concern. This is discussed in Section 5.5 in the context of in-combination effects.

5.4.1.4 The potential effects of disturbance on mallard using functionally linked land associated with the Humber Estuary SPA were also considered. It was concluded that any short term and small scale disturbance to the mallard present along a short section of the River Trent and its immediately adjacent banks would have no adverse effects on the site integrity of the Humber Estuary SPA.

5.5 In-combination Effects – Appropriate Assessment

5.5.1.1 The HRA screening found that further assessment was required to assess the potential effects of operational emissions to air from the Project in-combination with operational emissions from the Keadby 2 Power Station Project and the Keadby 3 Low Carbon Gas Power Station Project. This section assesses the potential for in-combination effects on designated sites as a result of these combined emissions.

5.5.1.2 As described in Section 5.2, several of the European sites that are affected by significant or insignificant contributions by Keadby 2, Keadby 3 and the Project have predicted environmental concentrations that exceed their critical levels for ammonia and/or their critical loads for nutrient nitrogen and acid deposition. As a result, any further exposure to atmospheric

concentrations of ammonia or to deposition of nutrient nitrogen and acid could have in-combination effects. It is important therefore to consider the wider context, particularly in terms of future trends given the Project Development will not begin to emit until 2028.

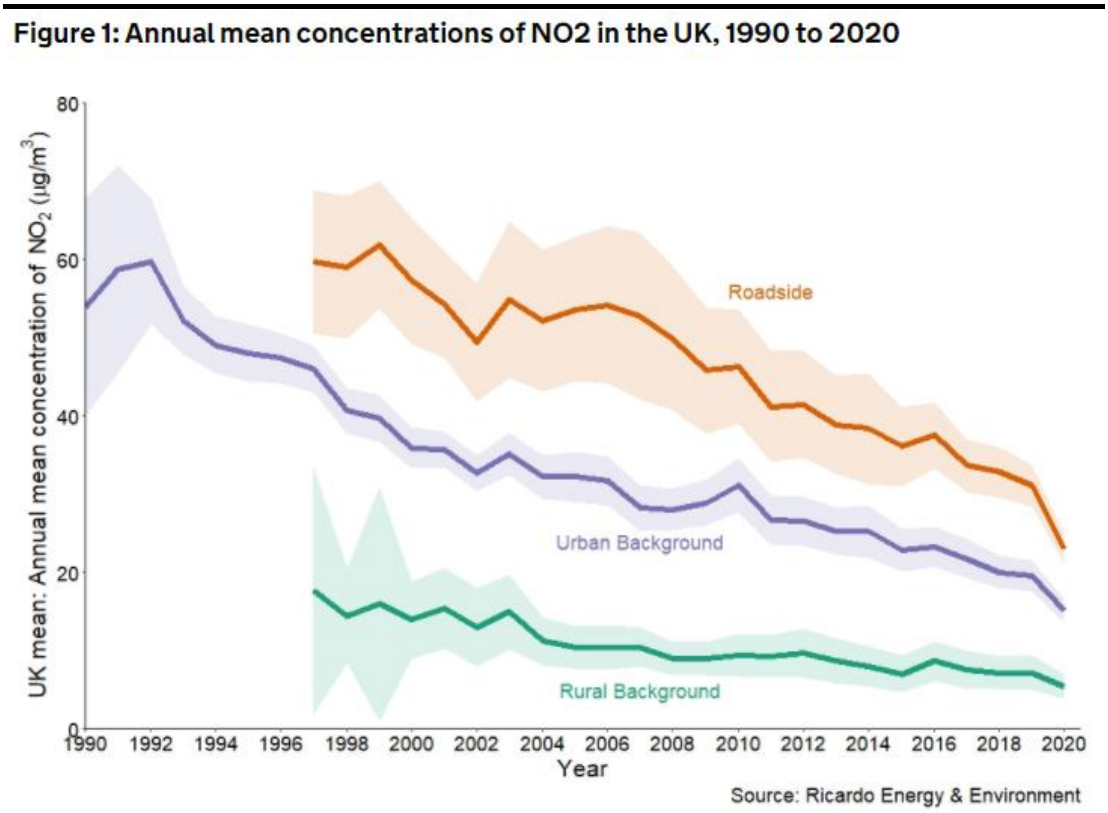
5.5.2 Baseline Trends

5.5.2.1 Air quality has been regulated in the UK for many hundreds of years. Modern regulation really began in earnest in the 1950s in response to the widespread pollution episodes (smogs) that afflicted UK cities. More recently regulation has been driven further by the need to improve urban air quality for the protection of health and the need to protect biodiversity in particular from acid rain events linked to UK emissions.

5.5.2.2 These regulatory drivers, alongside social, health and climate change pressures, have seen very substantial reductions in emissions in the UK. The use of coal for power generation has all but disappeared; renewable electricity has further reduced the use of coal, gas, and oil for power; emissions from road vehicles have continuously decreased; and industrial emissions have decreased substantially in line with ever more stringent emissions regulations.

5.5.2.3 In the case of in-combination effects, the principal pollutants of interest emitted by the Project are oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and ammonia (NH_3), all of which are pollutants in their own right as well as all contributing to acid deposition. Sulphur emitted by the Project is considered in terms of its contribution to acid deposition only as the other developments screened in are not emitters of sulphur. Figure 1 shows the trend in ambient concentrations of NO_2 in the UK 1990 to 2020. This highlights the magnitude of the change, noting that ambient concentrations of rural NO_2 has reduced by more than half in this period.

Figure 1: Pollution Trend NO_2



Source: gov.uk [37]

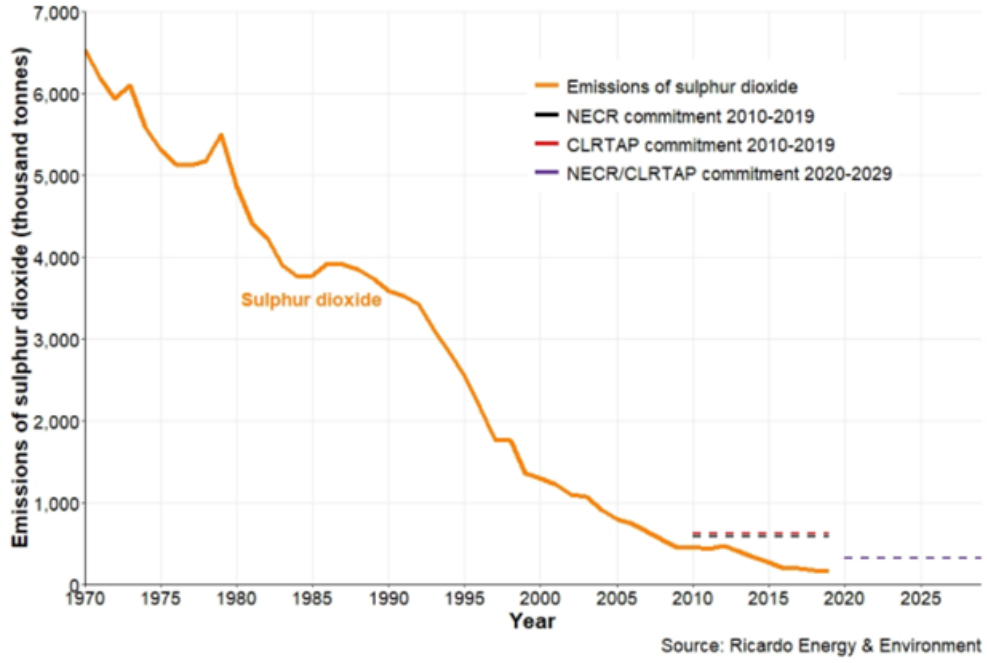
5.5.2.4 NO_2 emissions, and by definition their contribution to acid and nitrogen deposition, will continue to reduce in the future. The UK remains committed to the European Union's Best Available Techniques Reference Notes (Bref Notes), which will continue to drive down emissions. Vehicle emissions will continue on a downward trajectory, and this will accelerate with the increasing uptake of electric vehicles.

5.5.2.5 The trend in SO_2 emissions has been even more pronounced than NO_2, with a 97% reduction between 1970 and 2020. The wind down of coal fired power generation, the replacement of domestic coal with gas and electricity, road fuel desulphurisation and the increased regulation of industrial SO_2 emissions has drastically reduced emissions. This is illustrated in Figure 2.

[37] Office of National Statistics (accessed January 2022) Concentrations of nitrogen dioxide

Figure 2: Emissions Trend SO_2

Figure 2: Annual emissions of sulphur dioxide in the UK: 1970 – 2019



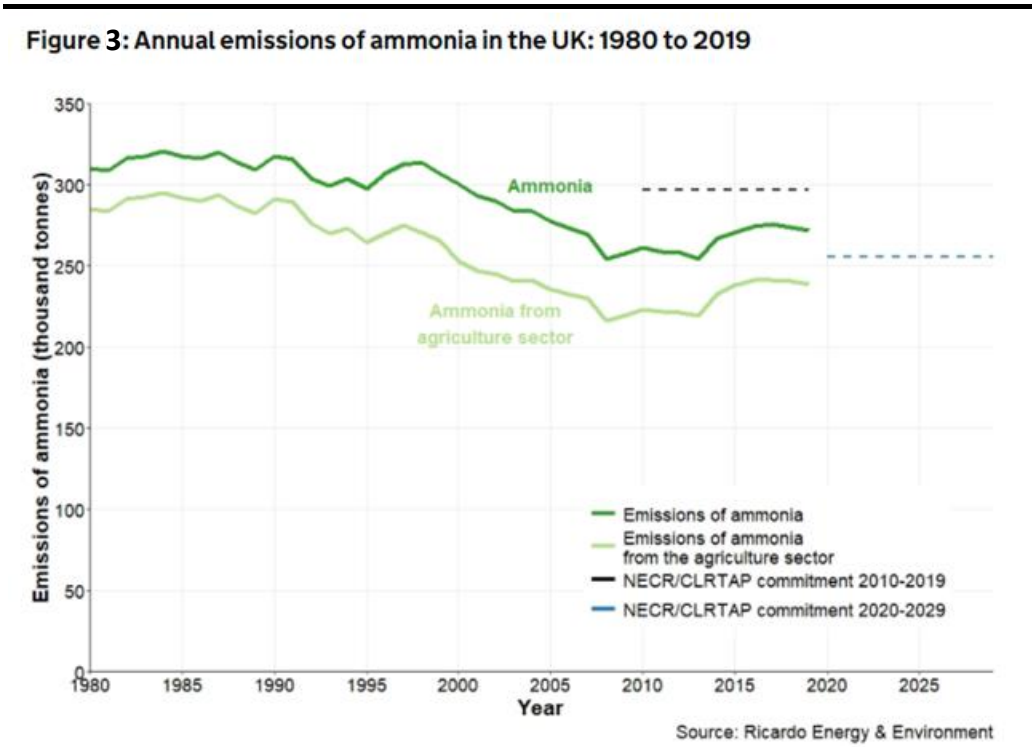
Source: Office of National Statistics[38]

5.5.2.6 SO_2 emissions, and their contribution to acid deposition, will also continue to reduce. Clearly the trend will be less than previously due to the huge gains made in emissions reductions over the last fifty years, but improvements, for example driven through the Bref process and uptake of zero carbon technologies will continue.

5.5.2.7 The trend in emissions of ammonia to air are far less pronounced compared to NO2 and SO2. The trends in ammonia emissions are shown in Figure 3.

[38] Office of National Statistics (accessed January 2022) Emissions of air pollutants in the UK – Sulphur dioxide (SO_2) https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-sulphur-dioxide-so2#:~:text=Emissions%20of%20sulphur%20dioxide%20have,level%20in%20the%20time%20series.&text=The%20UK%20meets%20the%20current,the%20period%202010%20to%202019.

Figure 3: Emissions Trend NH3



5.5.2.8 By far the greatest source of ammonia emissions is agriculture with over 80% of emissions from this sector. The trend at the moment is, if anything, towards higher emissions. However, the agricultural sector has been paid scant attention in terms of the emissions to air with little meaningful regulation of emissions. Agricultural emissions are specifically picked up as a key topic in the UK Government's 2019 Air Quality Strategy. The strategy sets out national policy to address ammonia emissions from agriculture with the specific intention of driving these downwards.

5.5.3 Conclusions on In-combination Effects on European Sites

5.5.3.1 Clearly UK emissions, and their contribution to acid and nutrient nitrogen deposition, will be dominant at the designated sites close to the project. However, transboundary pollution also contributes to the overall pollution burden and acid and nitrogen deposition in the UK. Emissions from the European Union (EU) dominate transboundary emissions of NO_x/NO_2, SO_2 and NH_3. Similar to the UK, there have been substantial reductions in emissions and airborne concentrations of pollutants across the EU. These improvements have been driven by the same drivers as exist in the UK and will also continue in the future.

5.5.3.2 In addition to the wider baseline it is also worth considering the likely changes to emissions and ambient concentrations in closer proximity to the Project. There are new emission sources in the form of Keadby 2 and Keadby 3 gas fired power plants a few kilometres to the southwest. However, there are several notable emission reductions, for example the

Keadby 1 gas fired power station that has been taken completely off-line. It had emissions limits at least twice that of the new Keadby plants. The fleet of coal fired power plants that once dominated the Trent valley are all defunct now or very soon will be, Drax has moved to biomass with lower emissions of SO_2 in particular and Scunthorpe steelworks is required to meet BAT through the Bref process, further reducing emissions. The regional vehicle and transportation emissions continue to reduce, mirroring the national trend.

5.5.3.3 When the international, national, and local factors are all combined, a clear trend emerges that emissions and ambient concentrations, and therefore associated acid and nitrogen deposition, have reduced massively over the last 50 years and will continue to decrease. Whilst there have been 'big wins' in industry in the last 50 years, the downward trend will continue with the further uptake of BAT at industrial sites and further improvements in traffic and uptake of electrical vehicles. The Low Carbon Economy (LCE) may also further accelerate emissions reductions as industries move towards low and zero carbon technologies, further removing combustion sources.

5.5.3.4 When taken in this wider context, it is clear that the continued improvement in baseline air quality and deposition described above in a local context, are important in assessing whether there are likely to be any adverse effects on European site integrity from in-combination effects. The effects of the project alone are predicted not to have adverse effects on the site integrity of the Humber Estuary SAC, SPA or Ramsar site, Thorne Moor SAC or Thorne & Hatfield Moors SPA, for the reasons described in Section 5.2 above. Whilst Keadby 2 and 3 power plants are both much larger emitters than the Project, it is clear that the new emissions from them will be offset by the closure of Keadby 1, the changes to the other facilities described and other continuing improvements to the background levels and loads. Hence adverse effects on the integrity of these European sites are not predicted as a result of emissions to air and associated acid and nitrogen deposition in-combination with other developments.

APPENDIX 1 HRA MATRICES

December 2022

NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

North Lincolnshire Green Energy Park

Appendix 1 HRA Matrices

December 2022

The business of sustainability

ERM

CONTENTS

List of Tables

1. APPENDIX 1 – HRA MATRICES

1.1.1.1 This appendix presents the HRA Matrices which are required as part of the DCO submission as described in the Planning Inspectorate's Advice Note 10[1]. These matrices provide a summary of Stage 1 and Stage 2 of the shadow HRA in a standardised form.

1.1.1.2 The European sites included within the screening assessment are:

- Humber Estuary SAC;
- Humber Estuary Ramsar;
- Humber Estuary SPA;
- Thorne Moor SAC; and
- Thorne & Hatfield Moors SPA.

1.1.1.3 Potential effects upon the European sites which are considered within the submitted HRA report (Annex 5: HRA Report) are provided in the table below.

Table 1: Effects considered within the screening matrices

Designated Site	Effects described in submission information	Presented in screening matrices as
■ Humber Estuary SAC ■ Humber Estuary Ramsar ■ Humber Estuary SPA ■ Thorne Moor SAC ■ Thorne & Hatfield Moors SPA	■ operational emissions to air including effects of NO_x (annual mean and 24 hr), NH_3, SO_2, HF (weekly and 24 hr), nitrogen deposition and acid deposition	■ Air Quality
■ Humber Estuary SAC ■ Humber Estuary Ramsar	■ construction dust and traffic emissions	■ Air Quality
■ Humber Estuary Ramsar	■ disturbance or displacement of qualifying interest birds due to factors such as noise, vibration, lighting, traffic, vessel movement and human disturbance ■ recreational disturbance	■ Disturbance
■ Humber Estuary SPA	■ disturbance or displacement of SPA qualifying feature birds from the River Trent (functionally linked land)	■ Disturbance to Functionally Linked Land
■ Humber Estuary SAC ■ Humber Estuary Ramsar	■ changes in water quality due to surface water interactions	■ Water Quality

[1] Advice Note 10: *Habitats Regulations Assessment relevant to nationally significant infrastructure projects*. The Planning Inspectorate. Republished November 2017, Version 8.

1.1.1.4 Evidence for, or against, likely significant effects on the European site(s) and its qualifying feature(s) is detailed within the footnotes to the screening matrices below.

Matrix Key:

✓ = Likely significant effect **cannot** be excluded
✗ = Likely significant effect **can** be excluded

C = construction
O = operation
D = decommissioning

Where effects are not applicable to a particular feature the matrix cell is formatted as follows:

1.2 Stage 1: Screening Matrices

Table 2: HRA Screening Matrix 1 – Humber Estuary SAC

Name of European site and designation: Humber Estuary Special Area of Conservation (SAC)												
EU Code: UK0030170												
Distance to NSIP: Adjacent at nearest point												
European Site Features	**Likely effects of NSIP**											
Effect	***Air Quality***			***Disturbance***			***Water Quality***			***In-combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**	**C**	**O**	**D**	**C**	**O**	**D**
1130 Estuaries	✓c	✓d	✓c				✓e	✓e	✓e	×f	✓g	×f
1140 Mudflats and sandflats not covered by seawater at low tide	×b	×b	×b				×b	×b	×b	×b	×b	×b
1110 Sandbanks which are slightly covered by sea water all the time	×b	×b	×b				×b	×b	×b	×b	×b	×b
1150 Coastal lagoons	×a	×a	×a				×a	×a	×a	×a	×a	×a
1310 *Salicornia* and other annuals colonising mud and sand	×a	×a	×a				×a	×a	×a	×a	×a	×a
1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	✓c	✓d	✓c				✓e	✓e	✓e	×f	✓g	×f
2110 Embryonic shifting dunes	×a	×a	×a				×a	×a	×a	×a	×a	×a
2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	×a	×a	×a				×a	×a	×a	×a	×a	×a
2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes")	×a	×a	×a				×a	×a	×a	×a	×a	×a
2160 Dunes with *Hippophae rhamnoides*	×a	×a	×a				×a	×a	×a	×a	×a	×a
1095 Sea lamprey (*Petromyzon marinus*)	×b	×b	×b	×b	×b	×b	×b	×b	×b	×b	×b	×b
1099 River lamprey (*Lampetra fluviatilis*)	×b	×b	×b	×b	×b	×b	×b	×b	×b	×b	×b	×b
1364 Grey seal (*Halichoerus grypus*)	×a	×a	×a	×a	×a	×a	×a	×a	×a	×a	×a	×a

a. European site feature is located within a part of the SAC which is over 15 km from the Project and no effects during construction, operation or decommissioning are expected for the Project alone, or in-combination with other developments (e.g. dune habitats are located at least 45 km from the Project) (Annex 5: HRA, Section 4.2.2).

b. European site features (habitat or species) are not considered sensitive and have been screened out as no effects are expected from the Project alone or in-combination with other developments (Annex 5: HRA, Section 4.2.2).

c. Impacts from emissions during construction and decommissioning (such as from traffic) were considered negligible and have been screened out from further consideration. However, in the absence of mitigation, potentially significant local impacts from construction dust on areas of upper saltmarsh or reedbed along the River Trent could not be excluded and further assessment was required (Annex 5: HRA, Section 4.5.5).

d. The screening assessment could not rule out the potential for significant effects of operational emissions as a result of NOx (24 hr), ammonia and nitrogen deposition (for estuary and Atlantic saltmeadow habitats) so further assessment was required (Annex 5: HRA, Section 4.4).

e. In the absence of mitigation, the screening assessment could not exclude the potential for significant water quality impacts on the River Trent section of the Humber Estuary SAC so further assessment was required (Annex 5: HRA, Section 4.5.4).

f. Potential impacts from the in-combination effect of other plans / projects during construction and decommissioning (such as from construction dust and surface water interactions) have been considered and the potential for significant in-combination effects was screened out. No likely significant effects were concluded (Annex 5: HRA, Section 4.6.2).

g. Potential in-combination effects of other plans / projects with regard to operational emissions to air (for ammonia and nitrogen deposition) could not be screened out and were assessed in the AA (Annex 5: HRA, Section 4.6.3).

Table 3: HRA Screening Matrix 2 – Humber Estuary Ramsar

Name of European site and designation: Humber Estuary Ramsar												
EU Code: UK11031												
Distance to NSIP: Adjacent at nearest point												
European Site Features	**Likely effects of NSIP**											
Effect	***Air Quality***			***Disturbance***			***Water Quality***			***In-combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**	**C**	**O**	**D**	**C**	**O**	**D**
Criterion 1 – Representative example of a near-natural estuary and associated estuarine habitats – saltmarsh habitats	✓e	✓a ×b	✓e				✓h	✓h	✓h	×i	✓k	×i
Criterion 3 – Breeding colony of grey seal (*Halichoerus grypus*) at Donna Nook and breeding site for natterjack toad (*Bufo calamita*) on the dune slacks at Saltfleetby-Theddlethorpe.	×c	×c	×c	×c	×c	×c	×c	×c	×c	×c	×c	×c
Criterion 5 – Waterfowl assemblage of international importance (non-breeding)[2].	✓e	×f	✓e	×g	×g	×g	✓h	✓h	✓h	×j	✓k	×j
Criterion 6 – species/populations occurring at levels of international importance. Includes wintering shelduck (*Tadorna tadorna*), golden plover (*Pluvialis apricaria*), knot (*Calidris canutus*), dunlin (*Calidris alpina alpina*), black-tailed godwit (*Limosa limosa islandica),* bar-tailed godwit (*Limosa lapponica*), and redshank (*Tringa totanus*)[3].	✓e	×f	✓e	×g	×g	×g	✓h	✓h	✓h	×j	✓k	×j
Criterion 8 – Migration route for both river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) between coastal waters and their spawning areas	×d	×d	×d	×d	×d	×d	×d	×d	×d	×d	×d	×d

a. The only Ramsar habitat sensitive to the predicted emissions to air identified within 15 km of the Project was saltmarsh. The screening assessment could not rule out the potential for significant effects as a result of operational emissions of NOx (24 hr), ammonia and nitrogen deposition on saltmarsh habitats of the Humber Estuary SAC and Ramsar (Annex 5: HRA, Section 4.4) so further assessment was required in the AA.

[2] Species with broad habitat types sensitive to emissions to air designated under this site feature include great bittern (*Botaurus stellaris*), marsh harrier (*Circus aeruginosus*), avocet (*Recurvirostra avosetta*), little tern (*Sterna albifrons*), dark-bellied brent goose (*Branta bernicla bernicla*), wigeon (*Anas penelope*) and curlew (*Numenius arquata*).

[3] Note: of this species list, only golden plover and black-tailed godwit have broad habitat types that are sensitive to emissions to air.

b. All other habitats designated under the Ramsar designation were either over 15 km from the Project so potential effects were screened out (e.g. dune habitats), or were located within 15 km from the Project but not sensitive to emissions to air (eg sandflats and mudflats). No effects on these habitats during construction, operation or decommissioning were expected for the Project alone, or in-combination with other developments (Annex 5: HRA, Section 4.2.2).

c. European site features over 15 km from the Project were screened out. Breeding colonies of grey seal and natterjack toad are situated in the outer Estuary, over 60 km from the Project. No effects are expected for the Project alone or in-combination with other developments (Annex 5: HRA, Section 4.2.2).

d. River and sea lamprey are not considered sensitive in this location and have been screened out as no effects are expected from the Project alone or in-combination with other developments (Annex 5: HRA, Section 4.2.2).

e. Impacts from emissions during construction and decommissioning (such as from traffic) were considered negligible and have been screened out from further consideration. However, in the absence of mitigation, potentially significant local impacts from construction dust on areas of upper saltmarsh or reedbed along the River Trent could not be excluded and further assessment was required (Annex 5: HRA, Section 4.5.5).

f. The operational emissions were not predicted to have a significant effect on the Humber Estuary SPA for NOx (annual or 24 hr), ammonia, SO2, HF or deposited nitrogen (in relation to the broad habitat type for qualifying bird species) as PC < 1% of the CL, or PEC < 70% of the CL for all of the emissions (which is classed as an insignificant contribution). As the Ramsar designation protects the same species, no likely significant effects on the qualifying interest birds of the Ramsar were identified as a result of emissions to air (Annex 5: HRA, Section 4.4).

g. Only small numbers of bird species designated as part of the Ramsar were recorded during bird surveys around the Project and no likely significant effect on the Humber Estuary Ramsar from disturbance to qualifying interest bird species was predicted (Annex 5: HRA, Section 4.5.1 and Section 4.5.3).

h. In the absence of mitigation, the screening assessment could not exclude the potential for significant water quality impacts on the River Trent section of the Humber Estuary Ramsar so further assessment was required (Annex 5: HRA, Section 4.5.4).

i. Potential impacts from the in-combination effect of other plans / projects during construction and decommissioning (such as from construction dust and surface water interactions) have been considered and the potential for significant in-combination effects was screened out. No likely significant effects in-combination with other developments were expected (Annex 5: HRA, Section 4.6.2).

j. The potential for additional disturbance to qualifying interest bird species of the Humber Estuary Ramsar was considered in-combination with other local projects. While some localised disturbance to local bird populations was predicted, the majority of developments were located over 1 km from the Humber Estuary Ramsar designation and the potential for in-combination disturbance effects was low. No likely significant in-combination disturbance effects on the Ramsar bird populations were expected (Annex 5: HRA, Section 4.6.4).

k. Potential in-combination effects of other plans / projects with regard to operational emissions to air (for ammonia and nitrogen deposition) could not be screened out and were assessed in the AA (Annex 5: HRA, Section 4.6.3).

Table 4: HRA Screening Matrix 3 – Humber Estuary SPA

Name of European site and designation: Humber Estuary Special Protection Area (SPA)									
EU Code: UK9006111									
Distance to NSIP: 6.5 km									
European Site Features	**Likely effects of NSIP**								
Effect	***Air Quality***			***Disturbance to Functionally Linked Land***			***In-combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**	**C**	**O**	**D**
Avocet (*Recurvirostra avosetta*), breeding and non-breeding	×c	×b	×c	×d	×d	×d	×f	✓h	×f
Bar-tailed godwit (*Limosa lapponica*), Non-breeding	×a	×a	×a	×d	×d	×d	×f	×f	×f
Bittern (*Botaurus stellaris*), Breeding and non-breeding	×c	×b	×c	×d	×d	×d	×f	✓h	×f
Black-tailed godwit (*Limosa limosa islandica),* Non-breeding	×c	×b	×c	×d	×d	×d	×f	✓h	×f
Dunlin (*Calidris alpina alpina*), Non-breeding	×a	×a	×a	×d	×d	×d	×f	×f	×f
Golden plover (*Pluvialis apricaria*), Non-breeding	×c	×b	×c	×d	×d	×d	×f	✓h	×f
Hen harrier (*Circus cyaneus*), Non-breeding	×a	×a	×a	×d	×d	×d	×f	×f	×f
Knot (*Calidris canutus*), Non-breeding	×a	×a	×a	×d	×d	×d	×f	×f	×f
Little tern (*Sternula albifrons*), Breeding	×c	×b	×c	×d	×d	×d	×f	✓h	×f
Marsh harrier (*Circus aeruginosus*), Breeding	×c	×b	×c	×d	×d	×d	×f	✓h	×f
Redshank (*Tringa totanus*), Non-breeding	×a	×a	×a	×d	×d	×d	×f	×f	×f
Ruff (*Calidris pugnax*), Non-breeding	×a	×a	×a	×d	×d	×d	×f	×f	×f
Shelduck (*Tadorna tadorna*), Non-breeding	×a	×a	×a	×d	×d	×d	×f	×f	×f
Waterbird assemblage, Non-breeding[4]	×c	×b	×c	✓e	✓e	✓e	×g	×g	×g

[4] Of the waterbird assemblage, the only listed species with broad habitat types sensitive to emissions to air are dark-bellied brent goose (*Branta bernicla bernicla*), wigeon (*Anas penelope*) and curlew (*Numenius arquata*).

a. Emissions to air were not expected to have a negative effect on a number of the qualifying bird species, either because the birds' broad habitat types were not sensitive, or there were no expected negative effects on the species as a result of effects on the species' broad habitat type. As these birds were not sensitive to the effects of emissions to air, no effects were expected for the Project alone or in-combination with other developments (Annex 5: HRA, Section 4.2.2).

b. The operational emissions were not predicted to make a significant contribution to the Humber Estuary SPA for NOx (annual or 24 hr), ammonia, SO2, HF or deposited nitrogen (in relation to the broad habitat type for these species) as PC < 1% of the CL, or PEC < 70% of the CL for all of the emissions. No likely significant effects on the SPA were identified (Annex 5: HRA, Section 4.4).

c. Impacts from emissions during construction and decommissioning (such as from traffic) were considered negligible and have been screened out from further consideration (Annex 5: HRA, Section 4.5.5). Therefore no effects on qualifying interest species are expected as a result of effects on their broad habitat types.

d. No functionally linked land was identified for these bird species. The Humber Estuary SPA lies 6.5 km to the north of the Project. At these distances, the potential for significant disturbance to bird species from the SPA (which have not been identified as using functionally linked land and only occur around the Project in low numbers) is negligible and no likely significant effect is expected (Annex 5: HRA, Section 4.5.2 and Section 4.5.3).

e. As surveys suggested mallard (part of the waterbird assemblage) use the area of the River Trent adjacent to the Project in large enough numbers that it can be considered functionally linked land to the SPA, potential disturbance to mallard could not be screened out and further assessment was required (Annex 5: HRA, Section 4.5.2).

f. No pathway for in-combination effects identified during the assessment.

g. The in-combination screening assessment did not find potential for significant disturbance effects in-combination with other projects for mallard from the Humber Estuary SPA using the River Trent (functionally linked land). Only one other potential development was identified nearby to the River Trent which was at a sufficient distance from the Project that in-combination effects were considered unlikely (Annex 5: HRA, Section 4.6.4).

h. Potential in-combination effects of other plans / projects with regard to operational emissions to air (for ammonia and nitrogen deposition) could not be screened out and were assessed in the AA (Annex 5: HRA, Section 4.6.3).

Table 5: HRA Screening Matrix 4: Thorne Moor SAC

Name of European site and designation: Thorne Moor Special Area of Conservation (SAC)						
EU Co: UK0012915						
Distance to NSIP: 10.1 km						
European Site Features	**Likely effects of NSIP**					
Effect	***Air Quality***			***In combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**
7120 Degraded raised bogs still capable of natural regeneration		**×a**			**✓b**	

a. The operational emissions from the Project on the SAC were found to be insignificant (PC < 1%, or PC <10% of critical level / load) and no likely significant effects on Thorne Moor SAC were predicted as a result of emissions to air (Annex 5: HRA, Section 4.4).

b. Potential in-combination effects of other plans / projects with regard to operational emissions to air (for ammonia, nitrogen deposition and acid deposition) could not be screened out and were assessed in the AA (Annex 5: HRA, Section 4.6.3).

Table 6: HRA Screening Matrix 5: Thorne & Hatfield Moors SPA

Name of European site and designation: Thorne & Hatfield Moors Special Protection Area (SPA)						
EU Co: UK9005171						
Distance to NSIP: 10.1 km						
European Site Features	**Likely effects of NSIP**					
Effect	***Air Quality***			***In combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**
Coniferous woodland and dwarf shrub heath[5] supporting European nightjar		**×a**			**✓b**	

a. The operational emissions from the Project on the SAC were found to be insignificant (PC < 1%, or PC <10% of critical level / load) and no likely significant effects on Thorne & Hatfield Moors SPA were predicted as a result of emissions to air (Annex 5: HRA, Section 4.4).

b. Potential in-combination effects of other plans / projects with regard to operational emissions to air (for ammonia and nitrogen deposition) could not be screened out and were assessed in the AA (Annex 5: HRA, Section 4.6.3).

[5] Of these habitat types supporting European nightjar, only dwarf shrub heath is sensitive to the potential effects of emissions to air.

1.3 Stage 2: Integrity Matrices

1.3.1.1 Stage 2 Integrity Matrices are provided for each European site where a likely significant effect was identified at Stage 1 (Screening).

1.3.1.2 Likely significant effects could not be excluded for the following sites:

- Humber Estuary SAC;
- Humber Estuary Ramsar;
- Humber Estuary SPA;
- Thorne Moor SAC; and
- Thorne & Hatfield Moors SPA.

1.3.1.3 These sites have been subject to further assessment in order to establish if the NSIP could have an adverse effect on their integrity. Potential effects upon the European sites which are considered within the AA section of the HRA report (Annex 5: HRA Report) are summarised in the table below.

Table 7: Effects considered within the integrity matrices

Designated Site	Effects described in submission information	Presented in integrity matrices as
■ Humber Estuary SAC ■ Humber Estuary Ramsar ■ Humber Estuary SPA ■ Thorne Moor SAC ■ Thorne & Hatfield Moors SPA	■ operational emissions to air including effects of NO_x (24 hour), ammonia, nitrogen and acid deposition	■ Air Quality
■ Humber Estuary SAC ■ Humber Estuary Ramsar	■ construction dust	■ Air Quality
■ Humber Estuary SPA	■ disturbance or displacement of mallard (an SPA qualifying species as part of the wintering waterbird assemblage) using the River Trent as functionally linked land	■ Disturbance to Functionally Linked Land
■ Humber Estuary SAC ■ Humber Estuary Ramsar	■ changes in water quality due to surface water interactions	■ Water Quality

1.3.1.4 Evidence for the conclusions on integrity is detailed within the footnotes to the matrices below.

Matrix Key:

✓ = Adverse effect on integrity **cannot** be excluded
✗ = Adverse effect on integrity **can** be excluded

C = construction
O = operation
D = decommissioning

Where effects are not applicable to a particular feature the matrix cell is formatted as follows:

Table 8: HRA Integrity Matrix 1 – Humber Estuary SAC

Name of European site and designation: Humber Estuary Special Area of Conservation (SAC)									
EU Code: UK0030170									
Distance to NSIP: Adjacent at nearest point									
European Site Features				**Adverse effect on integrity**					
Effect	***Air Quality***			***Water Quality***			***In-combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**	**C**	**O**	**D**
1130 Estuaries	✖a	✖b	✖a	✖c	✖c	✖c		✖d	
1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (saltmarsh)	✖a	✖b	✖a	✖c	✖c	✖c		✖d	

a. The final CEMP will contain best practice measures that will be implemented by the site contractors to control dust, so that there is negligible effect beyond the Red Line Boundary. Therefore, no adverse effect on the site integrity of the Humber Estuary SAC is expected (Annex 5: HRA, Section 5.2.5).

b. For both European site features, the underlying sensitive habitat assessed was saltmarsh. Operational emissions to air of NOx (24 hr), ammonia and nitrogen deposition were not expected to have a significant effect on the sensitive saltmarsh habitats of the SAC. The main reasons were that the majority of emissions only slightly exceeded the 1% threshold of the critical level / load, the localised areas of effect and the very small percentage of these habitats being affected across the Humber Estuary SAC as a whole. No adverse effects on the integrity of the Humber Estuary SAC were predicted (Annex 5: HRA, Section 5.2).

c. There will be no direct construction, operational or decommissioning water interactions with the River Trent. The River Trent is downstream of the Project and may be indirectly affected by surface water runoff which will ultimately enter the river. However, as industry best practice techniques and mitigation measures will be followed for all surface water crossing and interactions, impacts on local water resources are expected to be negligible. No adverse effects on the integrity of the Humber Estuary SAC are expected (Annex 5: HRA, Section 5.2.4).

d. In-combination effects of operational emissions to air were considered but factors such as local emissions reductions (e.g. closure of Keadby 1), changes in other local facilities and continued improvements to the background air quality and deposition levels locally and nationally were expected to offset increased emissions from the combined local developments. The in-combination assessment found that adverse effects on the integrity of Humber Estuary SAC were not predicted as a result of emissions to air in-combination with other developments (Annex 5: HRA, Section 5.5.3).

Table 9: HRA Integrity Matrix 2 – Humber Estuary Ramsar

Name of European site and designation: Humber Estuary Ramsar									
EU Code: UK11031									
Distance to NSIP: Adjacent at nearest point									
European Site Features	**Adverse effect on integrity**								
Effect	***Air Quality***			***Water Quality***			***In-combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**	**C**	**O**	**D**
Criterion 1 – Representative example of a near-natural estuary and associated estuarine habitats	**×a**	**×b**	**×a**	**×c**	**×c**	**×c**		**×d**	

a. The final CEMP will contain best practice measures that will be implemented by the site contractors to control dust, so that there is negligible effect beyond the Red Line Boundary. Therefore, no adverse effect on the site integrity of the Humber Estuary Ramsar is expected (Annex 5: HRA, Section 5.2.5).

b. Operational emissions to air of NOx (24 hr), ammonia and nitrogen deposition were not expected to have a significant effect on the sensitive saltmarsh habitats of the Humber Estuary Ramsar. The main reasons were that the majority of emissions only slightly exceeded the 1% threshold of the critical level / load, the localised areas of effect and the very small percentage of these habitats being affected across the Humber Estuary Ramsar as a whole. No adverse effects on the integrity of the Humber Estuary Ramsar were predicted (Annex 5: HRA, Section 5.2).

c. There will be no direct construction, operational or decommissioning water interactions with the River Trent. The River Trent is downstream of the Project and may be indirectly affected by surface water runoff which will ultimately enter the river. However, as industry best practice techniques and mitigation measures will be followed for all surface water crossing and interactions, impacts on local water resources are expected to be negligible. No adverse effects on the integrity of the Humber Estuary Ramsar are expected (Annex 5: HRA, Section 5.2.4).

d. In-combination effects of operational emissions to air were considered but factors such as local emissions reductions (e.g. closure of Keadby 1), changes in other local facilities and continued improvements to the background air quality and deposition levels locally and nationally were expected to offset increased emissions from the combined local developments. The in-combination assessment found that adverse effects on the integrity of Humber Estuary Ramsar were not predicted as a result of emissions to air in-combination with other developments (Annex 5: HRA, Section 5.5.3).

Table 10: HRA Integrity Matrix 3 – Humber Estuary SPA

Name of European site and designation: Humber Estuary Special Protection Area (SPA)						
EU Code: UK9006111						
Distance to NSIP: 6.5 km						
European Site Features	**Adverse effect on integrity**					
Effect	***Disturbance to Functionally Linked Land***			***In-combination effects***		
Stage of Development	**C**	**O**	**D**	**C**	**O**	**D**
Waterbird assemblage, Non-breeding (mallard only)	**×a**	**×a**	**×a**		**×b**	

a. The potential effects of disturbance (e.g. noise, visual disturbance, traffic, human disturbance) on mallard using functionally linked land associated with the Humber Estuary SPA were assessed further. In particular, the small increases in vessel movements over the course of the Project were considered but were not expected to create a significant disturbance effect. It was concluded that any short term and small scale disturbance to the mallard present along a short section of the River Trent would have no adverse effect on the site integrity of the Humber Estuary SPA (Annex 5: HRA, Section 5.3).

b. In-combination effects of operational emissions to air were considered but factors such as local emissions reductions (e.g. closure of Keadby 1), changes in other local facilities and continued improvements to the background air quality and deposition levels locally and nationally were expected to offset increased emissions from the combined local developments. The in-combination assessment found that adverse effects on the integrity of Humber Estuary SPA were not predicted as a result of emissions to air in-combination with other developments (Annex 5: HRA, Section 5.5.3).

Table 11: HRA Integrity Matrix 4 – Thorne Moor SAC

Name of European site and designation: Thorne Moor Special Area of Conservation (SAC)			
EU Code: UK0012915			
Distance to NSIP: 10.1 km			
European Site Features	**Adverse effect on integrity**		
Effect	***In-combination effects***		
Stage of Development	**C**	**O**	**D**
7120 Degraded raised bogs still capable of natural regeneration		**×a**	

a. In-combination effects of operational emissions to air were considered but factors such as local emissions reductions (e.g. closure of Keadby 1), changes in other local facilities and continued improvements to the background air quality and deposition levels locally and nationally were expected to offset increased emissions from the combined local developments. The in-combination assessment found that adverse effects on the integrity of Thorne Moor SAC were not predicted as a result of emissions to air in-combination with other developments (Annex 5: HRA, Section 5.5.3).

Table 12: HRA Integrity Matrix 5 – Thorne & Hatfield Moors SPA

Name of European site and designation: Thorne & Hatfield Moors Special Protection Area (SPA)			
EU Code: UK9005171			
Distance to NSIP: 10.1 km			
European Site Features	**Adverse effect on integrity**		
Effect	***In-combination effects***		
Stage of Development	**C**	**O**	**D**
Coniferous woodland and dwarf shrub heath supporting European nightjar		**×a**	

a. In-combination effects of operational emissions to air were considered but factors such as local emissions reductions (e.g. closure of Keadby 1), changes in other local facilities and continued improvements to the background air quality and deposition levels locally and nationally were expected to offset increased emissions from the combined local developments. The in-combination assessment found that adverse effects on the integrity of Thorne & Hatfield Moors SPA were not predicted as a result of emissions to air in-combination with other developments (Annex 5: HRA, Section 5.5.3).

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APPENDIX 2 FIGURES

December 2022

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 4 European Sites and SSSIs within 15 km of the Emissions Source

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	SD
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	120,000
ArcMap File	\\UKSSMBNAF- AQ_ES_DesignatedSites_15kmBuffer_A01

Legend

- Stack Location
- Order Limits
- 15km Buffer from Stack Location
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Ramsar Site
- Special Protection Area (SPA)

Layer Source Information

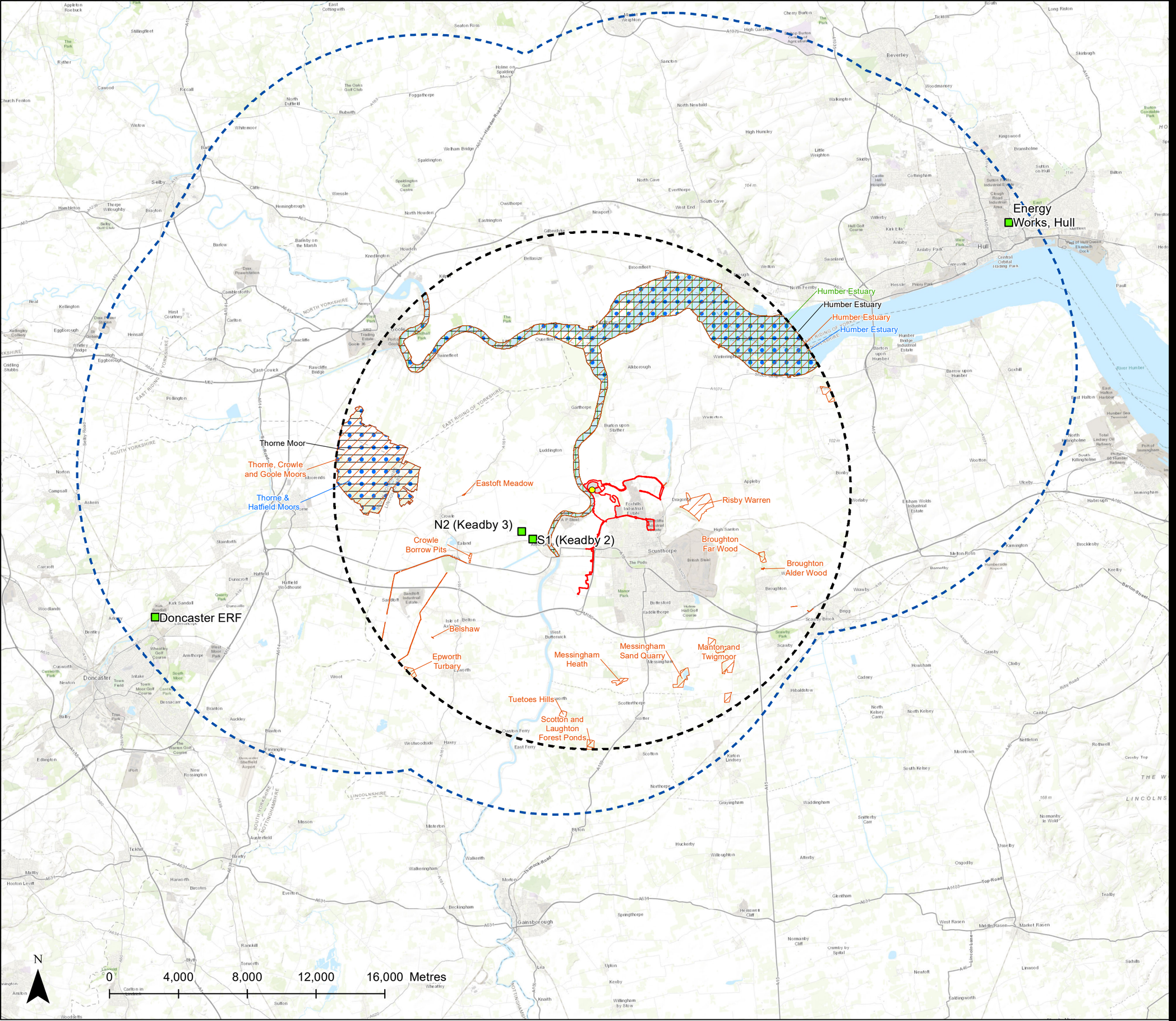
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

DO NOT SCALE THIS DRAWING

Humber Estuary
Humber Estuary
Humber Estuary
Humber Estuary
Thorne Moor
Thorne, Crowle and Goole Moors
Thorne & Hatfield Moors
Eastoft Meadow
Crowle Borrow Pits
Belshaw
Epworth Turbary
Messingham Heath
Messingham Sand Quarry
Manton and Twigmoor
Tuetoes Hills
Scotton and Laughton Forest Ponds
Risby Warren
Broughton Far Wood
Broughton Alder Wood

N

0 3,000 6,000 9,000 12,000 Metres



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 5 Proposed Large-scale Combustion Projects that are within a 15 km buffer of the Project's Main Emissions Sources and others within a further 15 km of European Protected Sites that occur within the Buffer

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	20/05/2022
Drawn by	MTC
Checked by	KM
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	200,000
ArcMap File	\\UKSSMBNAF-HRA_ES_DesignatedSites_InCombination_15kmBuffer_A01

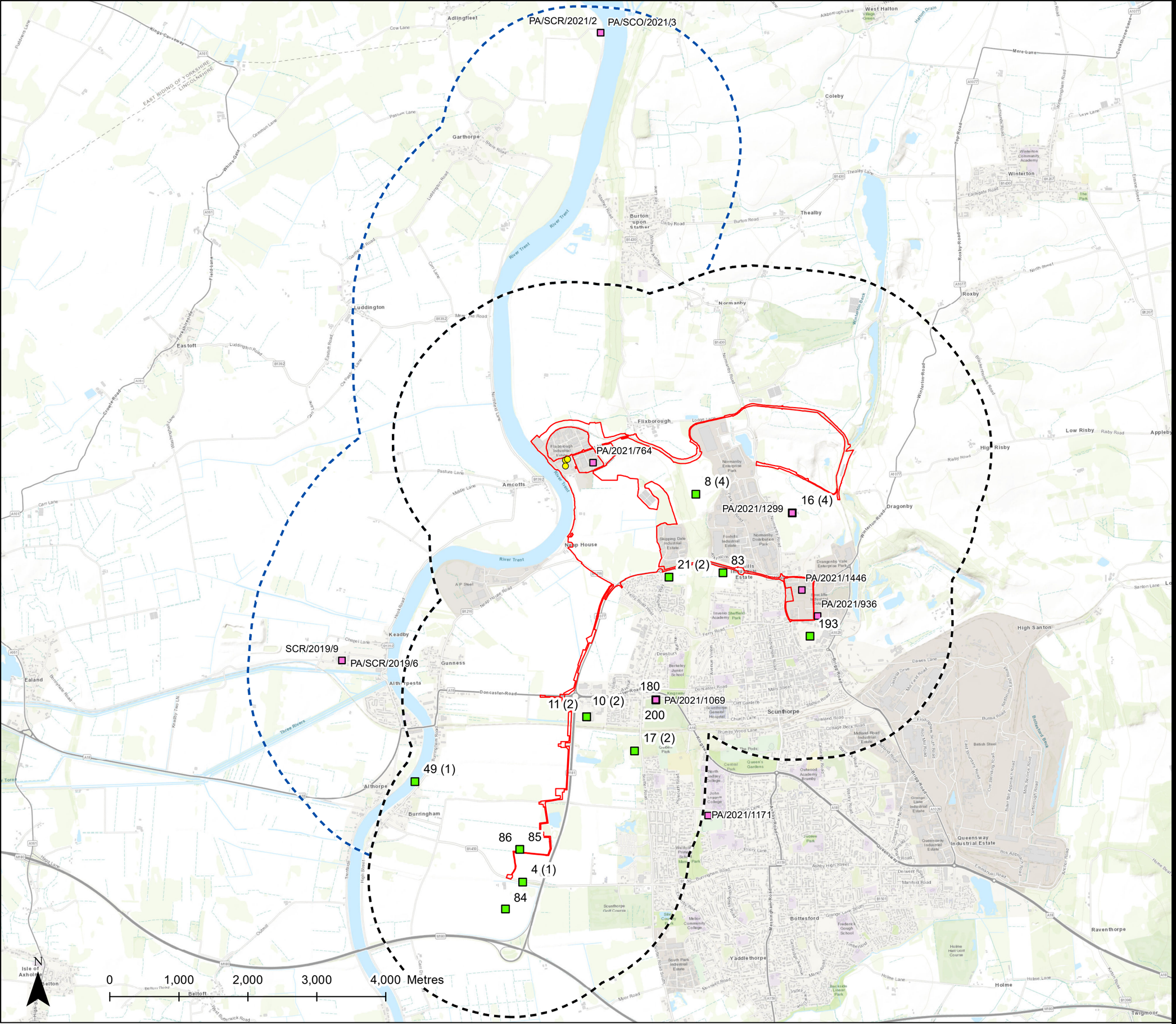
Legend

- Project Locations
- Stack Location
- Order Limits
- 15km Buffer from Stack
- 15km Buffer from Designated Sites
- Site of Special Scientific Interest
- Special Area of Conservation
- Ramsar Site
- Special Protection Area

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 6 Proposed Developments that are within a 2 km buffer of the Order Limits and others within a further 2 km of European Protected Sites that occur within the Buffer

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	20/05/2022
Drawn by	MTC
Checked by	SD
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	50,000
ArcMap File	\\UKSSMBNAF-HRA_ES_DesignatedSites_InCombination_2kmBuffer_A01

Legend

- Planning Applications
- Construction Project Location
- Stack Location
- Order Limits
- Order Limits 2km Buffer
- 2km Buffer from Designated Sites Beyond Order Limits 2km Buffer

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

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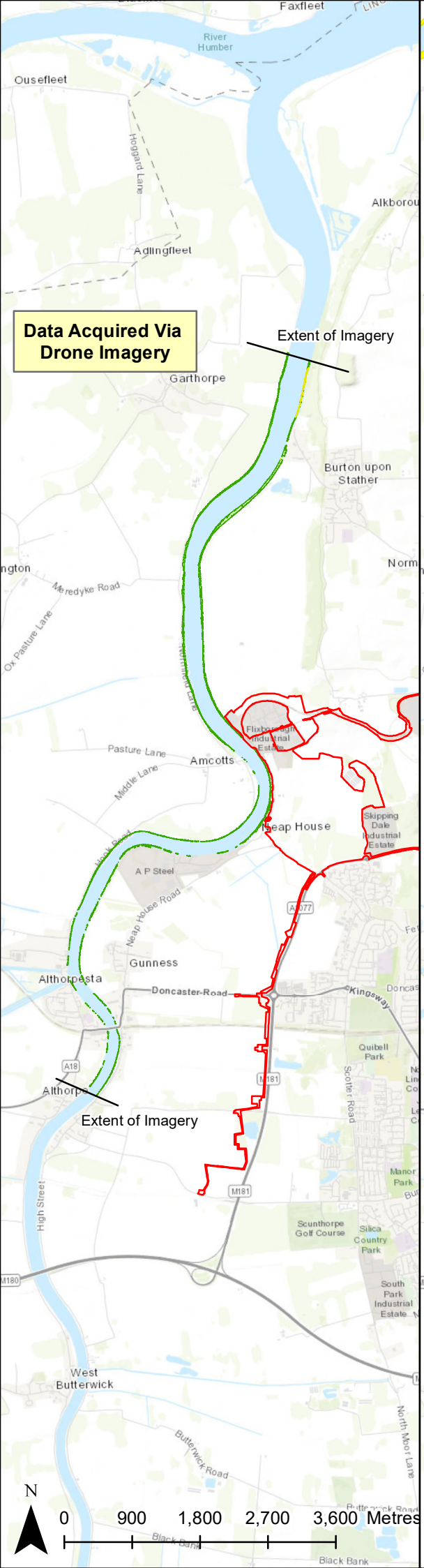

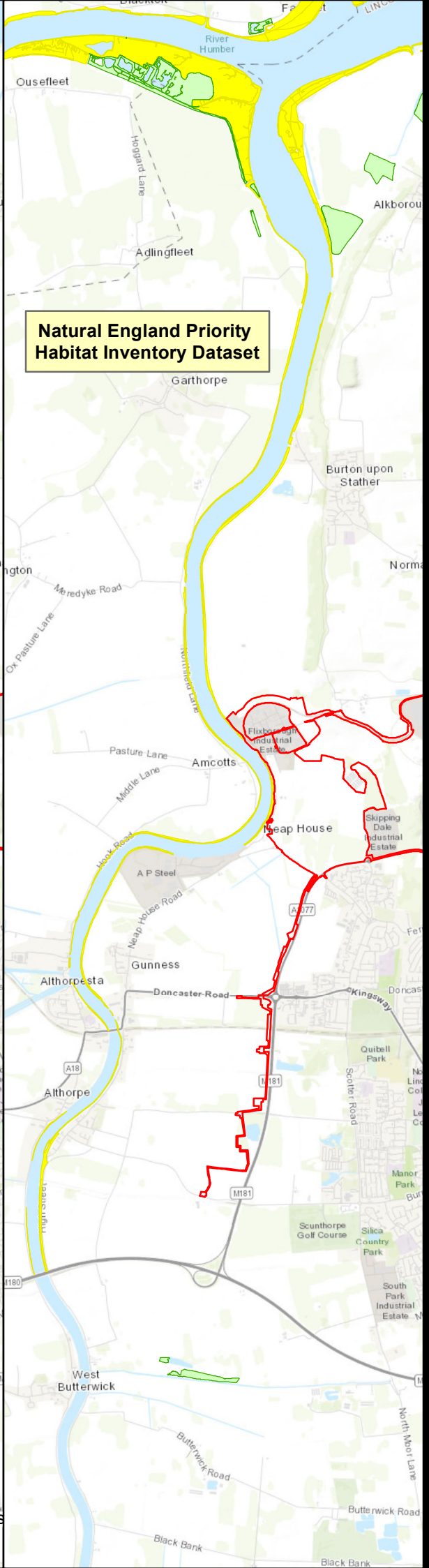

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North Lincolnshire Green Energy Park

Title	Figure 7 Reedbed Comparison

Client Information

Client	North Lincolnshire Green
PINS Proj No	Energy Park Ltd.
Date	EN010116
Drawn by	16/03/2022
Checked by	MTC
Version	SD

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	70,000

ArcMap File

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HRA_ES_ReedbedComparison_A01

Legend

- Order Limits
- Reedbeds
- Coastal

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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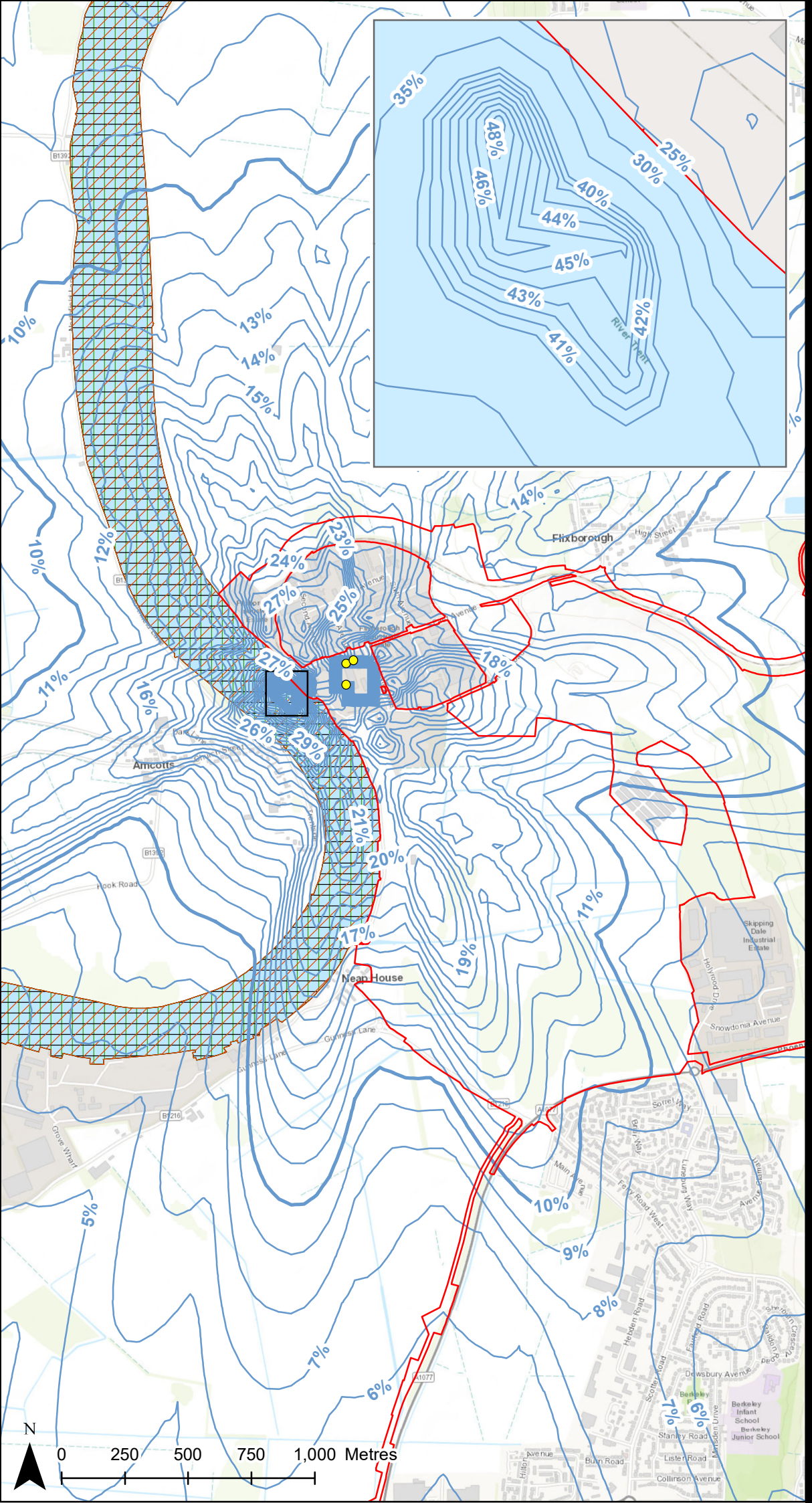

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 8 Contours NO_x 24hr

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MTC
Checked by	SD
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	20,000

ArcMap File

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HRA_ES_Contours_NOX_24_Hour_CL75_v4_A01

Legend

- Stack Location

NOx (24hr) Contour Plot: PC as % of Critical Level (CL). CL = 75 µg m^{-3}

- 10% of CL (threshold above which further assessment is required)
- 1% intervals
- Order Limits
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Ramsar Site
- Area Covered by all Three Designations (for inset map)

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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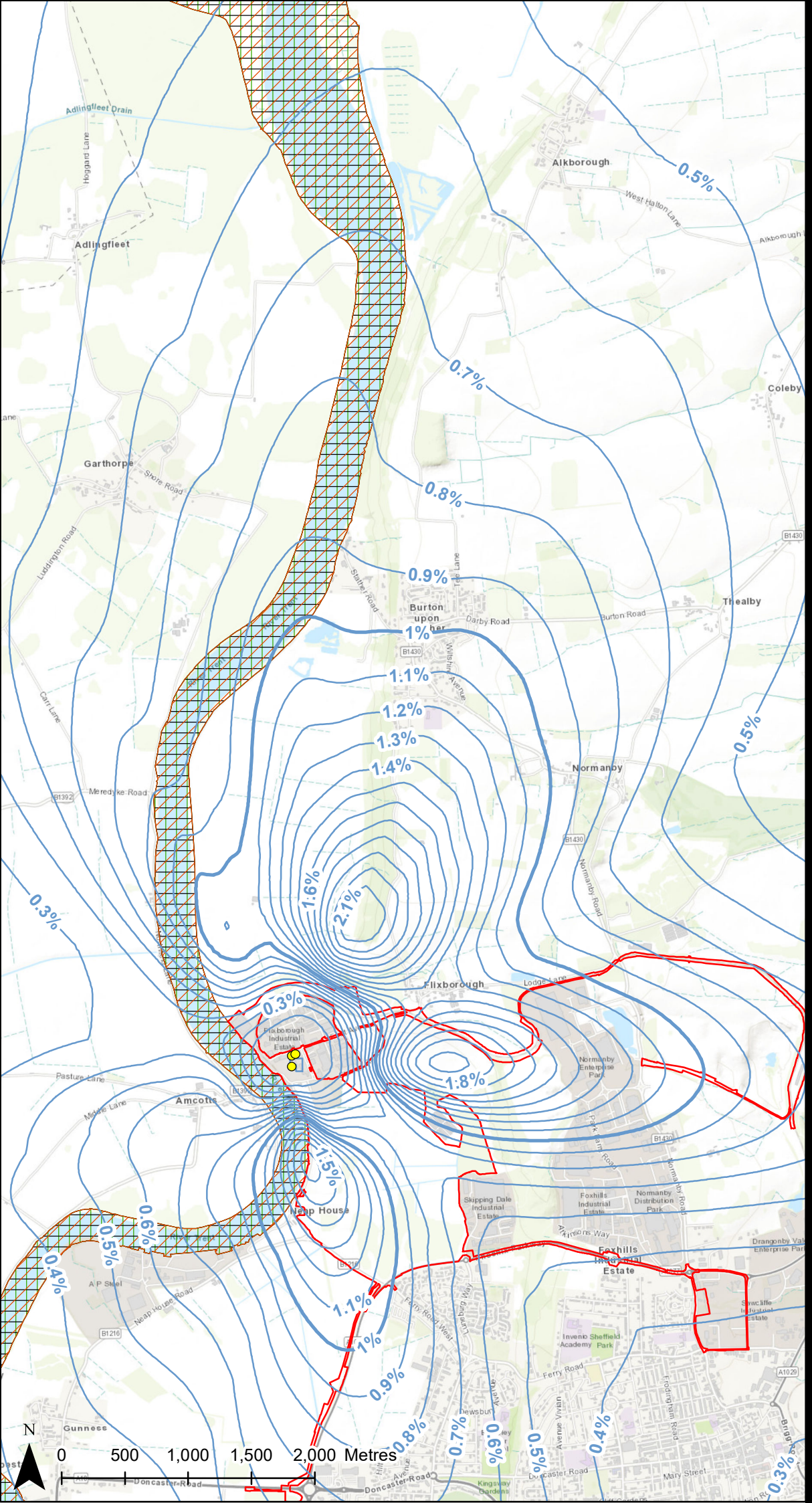

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 9 Contours NH^3 Annual

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MTC
Checked by	SD
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	40,000

ArcMap File

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HRA_ES_Contours_NH3_Annual_CL3_v4_A01

Legend

- Stack Location

Ammonia Contour Plot: PC as % of Critical Level (CL). CL = 3 µg m^{-3}

- 1% of CL (threshold above which further assessment is required)
- 0.1% intervals
- Order Limits
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Ramsar Site

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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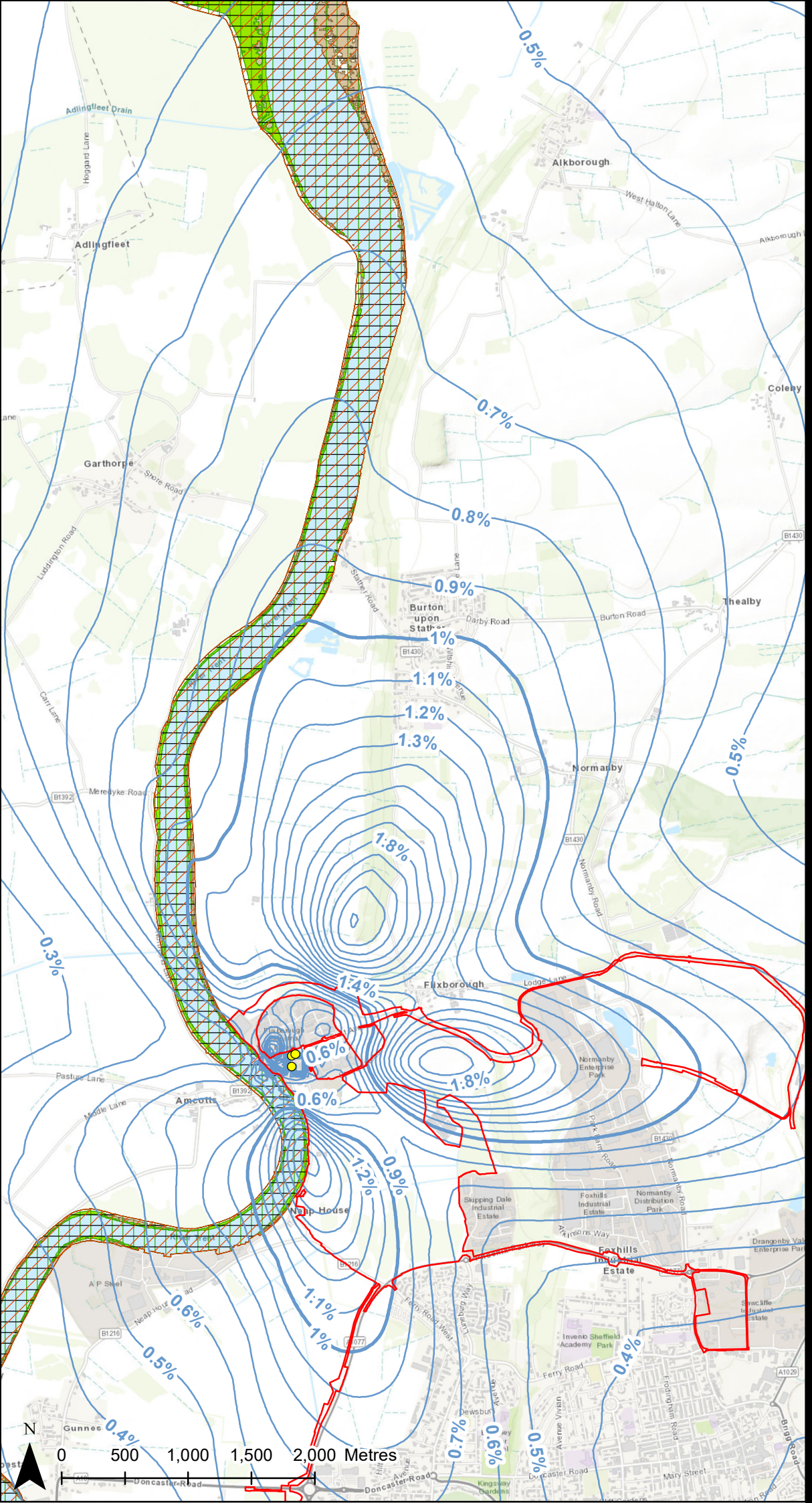

NORTH LINCOLNSHIRE GREEN ENERGY PARK

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North Lincolnshire Green Energy Park

Title	Figure 10 Contours ND Grassland

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MTC
Checked by	SD
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	40,000

ArcMap File

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HRA_ES_Contours_ND_CL20Grassland_v4_A01

Legend

- Stack Location

Nutrient Nitrogen Contour Plot: PC as % of Critical Load (CL) (min)

- 1% of CL (threshold above which further assessment is required)
- 0.1% intervals
- Order Limits
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Ramsar Site
- Reedbeds
- Upper Saltmarsh

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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List of Figures

Acronyms and Abbreviations

Name	Description
AA	Appropriate Assessment
APIS	Air Pollution Information System
CHP	Combined Heat and Power
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DHPWN	District Heat and Private Wire Network
EA	Environment Agency
EC	European Commission
EIA	Environmental Impact Assessment
ERF	Energy Recovery Facility
FCS	Favourable Conservation Status
HRA	Habitats Regulations Assessment
IROPI	Imperative Reasons of Overriding Public Interest

Name	Description
LSE	Likely Significant Effect
NLGEP	North Lincolnshire Green Energy Park
NSER	No Significant Effect Report
NSIP	Nationally Significant Infrastructure Project
PC	Process Contribution
PEC	Predicted Environmental Contribution
PEIR	Preliminary Environmental Information Report
SAC	Special Area of Conservation
SoS	Secretary of State
SPA	Special Protection Area

1. INTRODUCTION

1.1 Purpose of this Report

~~1.1.1.1~~ 1.1.1.1 North Lincolnshire Green Energy Park (NLGEP) (The Project) is classified as a Nationally Significant Infrastructure Project (NSIP) under sections 14 and 15 of The Planning Act 2008, as the generating capacity will be in excess of 50 megawatts electrical power (MW). It will therefore be consented under the Development Consent Order (DCO) regime.

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~~1.1.1.2~~ 1.1.1.2 If an application for an NSIP is likely to affect a European designated site and / or a European marine site of nature conservation importance[1], a report must be provided with the application showing the site(s) that may be affected together with sufficient information to enable the competent authority (the Secretary of State (SoS)) to make an Appropriate Assessment (AA), if required. This process is referred to as a Habitats Regulations Assessment (HRA).

1.1.1.3 This report presents the Report to inform Habitats Regulations Assessment (HRA) for the Project (including HRA Stage 1: Screening and HRA Stage 2: AA), which is required as part of the DCO submission as described in the Planning Inspectorate's Advice Note 10[2]. The set of matrices developed by the Planning Inspectorate and required to provide a summary of Stage 1 and 2 of the HRA in a standardised form are presented in Appendix 2~~1~~ to this report~~chapter~~.

~~1.1.1.3~~ 1.1.1.4 The Report contains updates to the version (Revision Number 1) from December 2022, to take account of further written re~~s~~presentations by and engag~~a~~ement with Natural England and other stakeholders as part of the Examination ~~in Public~~ process. The updates take account of revised air dispersion modelling based on a Reasonable Operating Case (ROC), ~~-~~rather than the previous modelling that was based on multiple worst-case scenarios. The ROC is intended to provide an understanding of the likely impacts from air quality. The assessment takes account also the new access road location being over 200 m from the Humber Estuary designations on the River Trent and adds further information about noise and vibration and the associated effects on lamprey and birds, along with the effects of mitigation that will be implemented. Further explanation of the ROC is provided in Appendix 1.

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1.2 The Project

~~1.2.1.1~~ 1.2.1.1 The North Lincolnshire Green Energy Park (NLGEP) ('the Project'), located at Flixborough, North Lincolnshire, is a Nationally Significant Infrastructure Project (NSIP) with an Energy Recovery Facility (ERF) capable of converting up to 760,000 tonnes of non-recyclable waste into 95 MW of electricity at its heart and a carbon capture, utilisation and storage (CCUS) facility which will treat the excess gasses released from the ERF to remove and store carbon dioxide (CO_2) prior to emission into the atmosphere.

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~~1.2.1.2~~ 1.2.1.2 The NSIP incorporates a switchyard, to ensure that the power created can be exported to the National Grid or to local businesses, and a water treatment facility, to take water from the mains supply or recycled process water to remove impurities and make it suitable for use in the boilers, the CCUS facility, concrete block manufacture, hydrogen production and the maintenance of the water levels in the wetland area.

[1] European sites comprise: Sites of Community Importance (SCI), Special Areas of Conservation (SAC), candidate SACs (cSAC), possible SACs (pSAC), Special Protection Areas (SPA), potential SPAs (pSPA) and, under UK law, Ramsar sites.
[2] Advice Note 10: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. The Planning Inspectorate. Republished November 2017, Version 8.

~~1.2.1.3~~ 1.2.1.3 The Project will include the following Associated Development to support the operation of the NSIP:

- a bottom ash and flue gas residue handling and treatment facility (RHTF);
- a concrete block manufacturing facility (CBMF);
- a plastic recycling facility (PRF);
- a hydrogen production and storage facility;
- an electric vehicle (EV) and hydrogen (H2) refuelling station;
- battery storage;
- a hydrogen and natural gas above ground installations (AGI);
- a new access road and parking;
- a gatehouse and visitor centre with elevated walkway;
- railway reinstatement works including, sidings at Dragonby, reinstatement and safety improvements to the 6km private railway spur, and the construction of a new railhead with sidings south of Flixborough Wharf;
- a northern and southern district heating and private wire network (DHPWN);
- habitat creation, landscaping and ecological mitigation, including green infrastructure and 65 acre wetland area;
- new public rights of way and cycle ways including footbridges;
- Sustainable Drainage Systems (SuDS) and flood defence; and
- utility constructions and diversions.

~~1.2.1.4~~ 1.2.1.5 The Project will also include development in connection with the above works such as security gates, fencing, boundary treatment, lighting, hard and soft landscaping, surface and foul water treatment and drainage systems and CCTV.

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~~1.2.1.5~~ 1.2.1.6 The Project also includes temporary facilities required during the course of construction, including site establishment and preparation works, temporary construction laydown areas, contractor facilities, materials and plant storage, generators, concrete batching facilities, vehicle and cycle parking facilities, offices, staff welfare facilities, security fencing and gates, external lighting, roadways and haul routes, wheel wash facilities, and signage. Areas of land within the red line boundary will remain in agricultural use.

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~~1.2.1.6~~ 1.2.1.7 The overarching aim of the Project is to support the UK's transition to a low carbon economy as outlined in the Sixth Carbon Budget (December 2020), the national Ten Point Plan for a Green Industrial Revolution (November 2020) and the North Lincolnshire prospectus for a Green Future. It will do this by enabling circular resource strategies and low-carbon infrastructure to be deployed as an integral part of the design (for example by reprocessing ash, wastewater and carbon dioxide to manufacture concrete blocks and capturing and utilising waste-heat to supply local homes and businesses with heat via a district heating network).

~~1.2.1.7~~ 1.2.1.8 Further details about the Project are provided in Chapter 3 of the ES, The Project Description and Alternatives (**Document Reference 6.2.3**)

2. APPROACH TO THE HRA

2.1 Overview

~~2.1.1.1~~ 2.1.1.1 The approach to the HRA follows the guidance set out in the Planning Inspectorate's Advice Note 10. It has also taken account of a range of other guidance material including that produced by Defra (2021)3, the European Commission (EC) (e.g. 20114, 20185), the DTA Habitats Regulations Handbook6 and case law. Other specific guidance in relation to HRA and air quality is considered in Section 3.1.

~~2.1.1.2~~2.1.1.1 *The process comprises four main stages:*

- Stage 1 Screening to identify the likely effects of a project on a European site and consider whether the effects are likely to be significant;
- Stage 2 Appropriate Assessment to determine whether the integrity of the European site will be adversely affected by the project;
- Stage 3 Assessment of Alternative Solutions to establish if there are any that will result in a lesser effect on the European site; and
- Stage 4 Imperative Reasons of Overriding Public Interest (IROPI) and Compensatory Measures to establish whether it is necessary for the project to proceed despite the effects on the European site, and to confirm that necessary compensatory measures are in place to maintain the coherence of the national site network.

~~2.1.1.3~~ 2.1.1.2 Each of the above stages is discussed in more in the following sections.

2.2 Stage 1 – Screening

~~2.2.1.1~~ 2.2.1.1 The screening stage examines the likely effects of a project either alone, or in combination with other projects and plans on a European site, and seeks to answer the question "can it be concluded that no likely significant effect will occur?" To determine if the construction and / or operation of the Project[7] is likely to have any significant effects on the designated sites, the following issues have been considered:

- could the proposals affect the qualifying interest and are they sensitive / vulnerable to the effect;
- the probability of the effect happening;
- the likely consequences for the site's conservation objectives if the effect occurred; and
- the magnitude, duration and reversibility of the effect, taking into account any mitigation built into the project design.

~~2.2.1.2~~ 2.2.1.2 The screening stage has therefore sought to conclude one of the following outcomes:

- no likely significant effect;

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[3] Habitats Regulations Assessments: Protecting a European Site (2021)
[4] European Commission (2011) *Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones with Particular Attention to Port Development and Dredging*. EC.
[5] European Commission (2018) Managing Natura 2000 Sites – The Provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. EC.
[6] Tyldesley, D. and Chapman, C. (2013) The Habitats Regulations Assessment Handbook, July 2021 edition UK: DTA Publications Limited.
[7] It has been assumed that any effects from decommissioning would be addressed in full by the Competent Authority closer to the time when it may occur, based on more specific information about the activities and processes involved, and also the prevailing environmental conditions.

- a likely significant effect will occur; or
- it cannot be concluded that there will be no likely significant effect.

2.2.1.3

~~2.2.1.3~~ Where the assessment concludes the second or third outcome, then the need for an AA is triggered[8].

~~2.2.1.4~~ 2.2.1.4 Natural England's internal guidance[9] states in paragraphs 4.3 to 4.5 that:

> 4.3 "In undertaking an assessment of 'likely significant effects' under the Habitats Regulations, authoritative case law has established that:
> - an effect is likely if it *"'cannot be excluded on the basis of objective information'"* (Case C-127-02 Waddenzee – refer para 45)
> - an effect is significant if it *"'is likely to undermine the conservation objectives'"* (Case C-127-02 Waddenzee – refer para 48)
> - in undertaking a screening assessment for likely significant effects *"'it is not that significant effects are probable, a risk is sufficient'"*…, but there must be credible evidence that there is *" 'a real, rather than a hypothetical, risk'"* (Boggis v Natural England and Waveney DC (2009) EWCA Civ 1061 – refer paras 36-37)
>
> 4.4 The Advocate General's opinion in Sweetman also offers some simple guidance that the screening step *"'operates merely as a trigger'"* which asks *"'should we bother to check?'"* (Case C-258/11 Sweetman Advocate General Opinion (refer paras 49-50).
>
> 4.5 As such, when determining whether air pollution from a plan or project has a *"'likely significant effect'"* upon a given qualifying feature under the Habitats Regulations, the extent to which there are risks of air pollution that might undermine the conservation objectives for the site is central."

2.2.1.5

~~2.2.1.5~~ Recent case law has also confirmed that measures intended to avoid, or reduce, the harmful effects of a project on a European site should not be taken into account at the screening stage (C-323/17 People over Wind). Such matters are to be taken into account as part of an AA. However, from an air quality perspective the assessment does take into account the embedded measures that are required to meet emission limits and air quality standards designed for the protection of human health.

~~2.2.1.6~~ 2.2.1.6 The screening assessment also has to include a consideration of other projects and whether likely significant effects to European sites may result in combination with these other projects.

~~2.2.1.7~~ 2.2.1.7 Other projects and plans that will be considered as part of the in-combination assessment will be agreed with the Competent Authority (in this case the Planning Inspectorate) and based on advice from Natural England and the Environment Agency. Account will be taken of case law including from Walton and Fraser v Scottish Ministers (2011)[10] and the Application for Judicial review by Newry Chamber of Commerce (2015)[11].

~~2.2.1.8~~ 2.2.1.8 In drawing up the list of other projects and plans, account will be taken also of the need to avoid "legislative overkill" that could occur through the inclusion of "… all plans and projects capable of having any effect whatsoever…" (Case C-258/11 Sweetman v An

[8] In the case of the third outcome, European guidance (*Assessment of Plans and Projects Significantly affecting Natura 2000 sites (2001)*) advises that sufficient uncertainty remains to indicate that an appropriate assessment should be carried out.
[9] Natural England Internal Guidance (2018) Approach to advising competent authorities on Road Traffic Emissions and HRAs V1.4 Final. NE.
[10] 2011 SCLR 686, [2011] CSOH 131, [2011] ScotCS CSOH_131, 2011 GWD 34-703
[11] Neutral Citation No. [2015] NIQB 65

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Board Pleanála (2013)[12]) and that there is credible evidence that the risk from these other projects and plans is real (see reference to Boggis above). This will include consideration of the likely effects of the project / plans on the conservation objectives of the European site(s) affected (Section 3.3).

2.3 Stage 2 – Appropriate Assessment

~~2.3.1.1~~ 2.3.1.1 Where an AA is required, its aim is to determine if the effects of a project will have an adverse effect on European sites. It should provide and analyse sufficient information to allow the competent authority to make this determination. AA should exclusively focus on the qualifying features of the European site, and it must consider any effects on the conservation objectives of those qualifying interests. It should also be based on, and supported by, evidence that is capable of standing up to scientific scrutiny. EC guidance states that without proper reasoning the assessment does not fulfil its purpose, and cannot be considered "appropriate" and therefore cannot be consented. In terms of what is reasonable, guidance states "to identify the potential risks, so far as they may be reasonably foreseeable in the light of such information as can be reasonably obtained"[13].

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~~2.3.1.2~~ 2.3.1.2 In undertaking an AA, there are two stages:

- a scientific evaluation of all the likely significant effects of a project alone, or in-combination with other projects, on the relevant qualifying interests of a European site; and
- a conclusion based on outcomes of the scientific evaluation as to whether the integrity of a European site will be compromised.

~~2.3.1.3~~ 2.3.1.3 The emphasis for AA is to prove that no adverse effects due to a project will occur which would undermine a European site's conservation integrity. Site integrity can be defined as: "the coherence of its structure and function across its whole area that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified"[14].

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~~2.3.1.4~~ 2.3.1.4 The assessment also needs to take into account any measures which will be implemented to avoid, or reduce the level of impact from a project. The Competent Authority may also consider the use of conditions or restrictions to help avoid adverse effects on site integrity.

~~2.3.1.5~~ 2.3.1.5 If the AA concludes that there will be an adverse effect on the integrity of the European site, or that there is uncertainty and a precautionary approach is taken, then consent can only be granted if there are no alternative solutions, Imperative Reasons of Overriding Public Interest (IROPI) is applicable and compensatory measures have been secured.

2.4 Stage 3 – Assessment of Alternative Solutions

~~2.4.1.1~~ 2.4.1.1 All feasible alternatives have to be analysed to ensure that there are none which "better respect the integrity of the site in question" and its contribution to the overall coherence of the Natura 2000[15] network (EC, 2018)[16]. Alternatives could include the

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[12] In Case C-258/11

[13] Scottish Natural Heritage (SNH) (2001) Natura Casework Guidance: Consideration of Proposals Affecting SPAs and SACs. SNH Guidance Note Series. SNH.

[14] European Communities (2000) Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. EC

[15] Referred to as a 'national site network' in the UK

[16] European Commission (2018) Commission Notice. "Managing Natura 2000 sites. The Provisions of Artice 6 of the 'Habitats' Directive 92/43/EEC" Brussels, 21.11.2018 C(2018) 7621 final.

location of the site, its scale and design, and the way in which it is constructed and operated. The "do nothing" option also has to be considered.

~~2.4.1.2~~ 2.4.1.2 The comparison of alternatives should not allow other assessment criteria (e.g. economics) to overrule ecological criteria (EC, 2018). However, the same guidance also refers to the opinion for the case C-239/04[17], where the opinion of the Advocate General was that "the choice does not inevitably have to be determined by which alternative least adversely affects the site concerned. Instead, the choice requires a balance to be struck between the adverse effect on the integrity of the SPA and the relevant reasons of overriding public interest".

2.5 Stage 4 – Imperative Reasons of Overriding Public Interest (IROPI) and Compensation Measures

~~2.5.1.1~~ 2.5.1.1 Where a development has an adverse effect on the integrity of a European site and there are no alternative solutions, consent can only be granted if there are imperative reasons of overriding public interest, including those of social or economic nature which would require the realisation of a project. A definition of "overriding public interest" does not occur in the directive; however examples considered are:

- human health, public safety or beneficial consequences of primary importance to the environment; and
- any other reasons which are considered by the Competent Authority to be IROPI; or
- if the site does not host a priority habitat or species then IROPI must be demonstrated, and the reasons can include those of a social, or economic nature.

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~~2.5.1.2~~ 2.5.1.2 If the importance of a project is deemed to outweigh the effects which will result on the European site, and there are no alternatives, compensatory measures must be secured before consent is granted. Compensatory measures are independent of a project and are intended to offset the adverse effects of a project, corresponding specifically to the negative effects on habitats and species concerned.

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~~2.5.1.3~~ 2.5.1.3 To be acceptable, compensatory measures should:

- take account of the comparable proportions of habitats and species which are adversely affected;
- be within the same bio-geographical range within which the European site is located;
- provide functions that are comparable to those which justified the selection of the original site; and
- have clearly defined implementation and management objectives so the measures can achieve the aim of maintaining the overall coherence of the network.

17 Commission of the European Communities V Portuguese Republic (2006) Case C-239/04.

2.6 Consultation

~~2.6.1.1~~ Table 2: Emissions and Relevant Environmental Standards 1~~Table 2: Emissions and Relevant Environmental Standards~~ presents excerpts from consultation responses on the PEIR which are relevant to the HRA.

Table 1: Consultation Responses

Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
1. Air Quality			
Chapter 5, paragraph 4.13.1.1 indicates that the effects on habitats within 10 km of the Energy Recovery Facility (ERF) have been assessed. Both Appendix A and Chapter 5 indicate that a 10 km radius from the Project was used. 'Project', in this instance, is assumed to refer to the Order Limits. It is therefore unclear what search radius has been used and this should be clarified.	Natural England	In the PEIR, the Ecology and HRA assessments identified all designated sites within 10 km of the point of the main ERF stacks, given that this is the key emission point potentially impacting sensitive ecology. The air quality modelling was undertaken using a similar buffer of 10 km from the ERF stacks. The search area has been extended to 15 km from the ERF stack for the ES **(Document Reference 6.0).**	Section 3.3
Chapter 5 states that initial modelling indicates a negligible risk of significant effects beyond 10 km, and therefore screening to 15 km has not been undertaken for European sites. It should be noted that Natural England has not yet had sight of the results of the initial modelling, so we have not been able to refer to this in our response. However it is relevant that Thorne Moor SAC is located within 15 km of the Order Limits and is notified for H7120 Degraded raised bogs (still capable of natural regeneration). H7120 Degraded raised bogs are sensitive to nutrient nitrogen and acid deposition. Natural England therefore advises that screening up to a minimum of 15 km of the Order Limits should be undertaken. Due to the nature of the proposed development and habitat sensitivities, it may also be appropriate to consider Hatfield Moor SAC and Thorne and Hatfield Moors SPA.	Natural England	As a result of this advice from Natural England, air quality modelling has been extended to include a buffer of 15 km from the ERF stack. We note the presence of Hatfield Moor SAC just outside this buffer zone and will consider the need to include this site dependent on the modelling results. Thorne Moor SAC and Thorne and Hatfield Moors SPA are included within the 15 km search area and are considered in the assessment.	Section 4.2
Chapter 5, paragraph 4.2.2.7 states that "no habitats or species of the European sites were found to be sensitive to acid deposition". Acid deposition has therefore been scoped out of the assessment. APIS indicates that several interest features of the SPA are sensitive to acid deposition and therefore this should be scoped into the assessment.	Natural England	Where ecological receptors within 15 km of the Project have relevant site specific Critical Loads for Acid Deposition and Nutrient Nitrogen Deposition (as identified from APIS), these have been included in the Air Quality Impact Assessment and fed into the HRA and fed into the Report to inform Habitats Regulations Assessments (HRA) (**Document Reference 5.9).**	Section 3.3

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Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
		The HRA acknowledges that a number of broad habitat types used by the SPA bird interest features are sensitive to acid deposition. However, APIS confirms that, for all relevant species, the bird species are not sensitive to any acidity impacts even if the broad habitat types are sensitive. Therefore, no qualifying interest features of the SPA were found to be sensitive to acid deposition.	
Water-based features at all sites in question have been scoped out as the nutrient nitrogen is thought to be influenced overwhelmingly by waterborne nutrient loadings and agricultural run-off rather than by deposition from the atmosphere. Natural England does not consider this suitable justification to scope out all aquatic features. Where a relevant environmental benchmark has been provided on APIS, these features should be assessed.	Natural England	This is noted. It is confirmed that environmental benchmarks have been used where they are provided by APIS e.g. salt marsh communities. The SAC water-based features that have been scoped out are: mudflats and sandflats not covered by seawater at low tide, river lamprey and sea lamprey. There are no environmental benchmarks provided on APIS for these features. APIS notes that marine and river habitats do not tend to be sensitive to air pollution impacts, or are dominated by other sources of inputs.	Section 4.2.2
Sand dune habitats have also been scoped out of the assessment for all sites in question. Dune systems are one of the most sensitive habitats to air pollution and, within the Humber Estuary SAC and SSSI, are already exceeding critical loads. Chapter 5, Section 8.3 summarises the findings of the Air Quality Impact Assessment (AQIA) and concludes that there are likely to be exceedances in nitrogen and acid deposition at Humber Estuary SSSI, SAC and SPA. Section 8.3 clearly identifies potentially significant contributions for dune habitats and concludes that detailed assessment is therefore required. Natural England are concerned then that dune habitats have not been included in the detailed assessments summarised in Appendix A and Chapter 5. Air quality impacts on sand dunes should be considered in further detail in the Appropriate Assessment.	Natural England	The potential significant contributions for dune habitats identified in the Air Quality Impact Assessment in the PEIR were based on modelling that assumed all habitat types were located within 10 km of the ERF. In reality, this is not the case and the HRA takes the further step of looking at the specific habitat locations within each designated site. All of the sand dune habitats are located at least 45 km from the Project and at this distance, effects on sand dunes as a result of air emissions will be negligible. Therefore effects on sand dunes have been scoped out of the Environmental Statement **(Document Reference 6.0**).	Section 4.2.2
7. Cumulative Impacts			
Finally, in-combination effects have not been considered at this stage and we would welcome this information when it becomes available.	Natural England	In-combination effects are now addressed in this report. We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18**).	Sections 4.6 and 5.5
The 'in-combination' requirement makes sure that the effects of numerous small proposals, which alone would not result in a significant effect, are assessed to determine whether their combined	Natural England	In-combination effects are now addressed in this report.	Sections 4.6 and 5.5

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Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
effect would be significant enough to require more detailed assessment. Natural England notes that the application site is in close proximity to a number of SSSIs. Based on the plans submitted, Natural England considers that the proposed development could have potential significant effects on the interest features for which the sites have been notified. Chapter 10 correctly identifies SSSIs for assessment.		We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18**). This includes assessing cumulative impacts on SSSIs in close proximity to the project.	
Plans or projects that should be considered in the in-combination assessment include the following: ▪ the incomplete or non-implemented parts of plans or projects that have already commenced; ▪ plans or projects given consent or given effect but not yet started; ▪ plans or projects currently subject to an application for consent or proposed to be given effect; ▪ projects that are the subject of an outstanding appeal; ▪ ongoing plans or projects that are the subject of regular review; ▪ any draft plans being prepared by any public body; and ▪ any proposed plans or projects published for consultation prior to application.	Natural England	In-combination effects are now addressed in this report. We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18**). This considers plans or projects as per the criteria outlined.	Sections 4.6 and 5.5
When assessing the effects on designated sites, Natural England recommends that the search radius for be measured from the nearest point on the designated site to the proposal being assessed, or the nearest area of sensitive habitat, if known. This would likely identify those proposals which are likely to affect overlapping geographic extents within the designated site in question.	Natural England	In-combination effects are now addressed in this report and considered this search area. We have assessed cumulative impacts in Chapter 18 of the ES (**Document Reference 6.2.18**). This considers the cumulative impact on ecological sites.	Sections 4.6 and 5.5
Chapter 18 of the PIER provides a list of projects to be included in an assessment of the potential in-combination effects. Keadby II Power Station has been identified for consideration within the baseline and is scoped out of the in-combination assessment. Natural England notes that the air quality screening assessment uses DEFRA Background Mapping dated 2018 and APIS background data dated 2017 - 2019. It is not clear whether emissions to air from Keadby II Power Station are included within these background data. The Applicant should make a thorough	Natural England	We have assessed cumulative impacts in Chapter 18: of the Environmental Statement (**Document Reference 6.2.18).** This considers emissions from Keadby 2 and Keadby 3. The assessment also considers the trends in the ~~long term~~long-term baseline on a regional, national and international basis, and assesses the overall likelihood of significant adverse impacts on sensitive ecological receptors due to in-combination effects	Sections 4.6, and 5.5 Section 4.6.1

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Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
check that all relevant emissions are included in the baseline assessment.			
10. Ecology			
Consideration of the Habitats Regulations is presented in Chapter 5 of the PEIR. Chapter 5 focusses solely on the potential effects of operational air quality. Paragraph 1.1.1.6 indicates that the screening matrices will include other potential effects arising from construction. Presumably this will be included with the Development Consent Order (DCO) submission. This should also consider other potential effects arising from operation. Natural England advises that the screening test should be carried out before the detailed assessment. Stage 1 of the Habitats Regulations Assessment (HRA), the Likely Significant Effect (LSE) test, should identify the potential for all construction and operational impacts of the proposed development on each interest feature of the European sites in question, both alone and in-combination with other plans and projects. We will provide our advice on the HRA when the relevant information for this stage in the application has been provided.	Natural England	This is noted and other effects (alone and in-combination) are now considered in this report.	Sections 4.5, 4.6.4 and 5.3
SACs are designated for rare and vulnerable habitats and species, whilst SPAs are classified for rare and vulnerable birds. Many of these sites are designated for mobile species that may also rely on areas outside of the site boundary. These supporting habitats may be used by SPA/SAC populations or some individuals of the population for some or all of the time. These supporting habitats can play an essential role in maintaining SPA/SAC species populations, and proposals affecting them may therefore have the potential to affect the European site. It should be noted that some of the potential impacts that may arise from the proposal relate to the presence of SPA interest features that are located outside the site boundary. Natural England advises that the potential for offsite impacts should be considered in assessing what, if any, potential impacts the proposal may have on European sites.	Natural England	This is noted. The potential for disturbance to qualifying interest bird species on functionally linked land is now considered in the HRA, as set out in Report to inform Habitats Regulations Assessment (**Document Reference 5.9).**	Sections 4.5, 4.6.4 and 5.3

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Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
Chapter 10, Appendix E Ornithology Surveys recorded a peak count of 42 mallard roosting and feeding along the banks of the River Trent. Mallard are an assemblage species of the Humber Estuary SPA / Ramsar and this represents 4% of the Humber Estuary population (based on a five year average from 2015/16 – 2019/20). The River Trent therefore is considered functionally linked land and the potential for bird disturbance should be a key consideration within the HRA.	Natural England	This is noted. The potential for disturbance to qualifying interest bird species on functionally linked land is considered in the HRA, as set out in the Report to inform Habitats Regulations Assessment (**Document Reference 5.9).**	Sections 4.5, 4.6.4 and 5.3
When identifying the potential for significant effects, we recommend that the seasonality of species designations be considered; for instance, whether there are records of a species during the season when it is identified as a designated site feature (e.g. during the breeding season). Although it is also worth considering impacts to those species at any time of year.	Natural England	This is agreed and is considered as part of the HRA as set out in the Report to inform Habitats Regulations Assessment (**Document Reference 5.9**).	Sections 4.5, 4.6.4 and 5.3
We welcome mitigation measures proposed in Chapter 10, Section 7. The specifics of these measures should be detailed in the Code of Construction Practice (CoCP) and Ecological Management Plan (EMP) which will need to be agreed with Natural England. Potential for noise, vibration and visual disturbance as a result of the construction and operation of the development should be a key consideration of the HRA process. Chapter 13 (Traffic and Transport), paragraph 8.2.5.3 indicates that there will be an additional 580 vessel movements per annum at Flixborough Wharf as a result of the proposed development. This represents a significant increase of 200% (when compared to 305 vessel movements in 2019) and should be considered within the HRA. As the development includes new access routes close to the designated site boundary, the HRA and SSSI assessment should also consider the potential for recreational disturbance impacts.	Natural England	The potential for disturbance (noise/vibration/visual) to qualifying interest bird features during construction and operation of the scheme is considered in the HRA. It is noted that the potential for recreational disturbance should also be included. The potential for disturbance (noise/vibration/visual) to qualifying interest bird features of the Humber Estuary SPA and Ramsar during construction and operation has been considered in the HRA – including the potential effect of vessel movement on birds using the River Trent. The potential for recreational disturbance has also been considered.	Sections 4.5, 4.6.4 and 5.3
21. Water Resources and Flood Risk			
It is understood that all water for use within the proposed development will be sourced from the Anglian Water mains supply, and all elements will be connected into a surface water drainage system and a sewerage system. Natural England welcomes mitigation measures proposed in Chapter 9, Section 7, as well as mitigation to prevent leaching of	Natural England	This is noted. The HRA considers the potential for impacts on water quality.	Section 4.5

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Consultation Response	Prescribed Consultee(s)	Response / Action	Reference within this document
construction pollutants into surface waters, as outlined in Chapter 9, paragraph 8.2.1.9. Potential for water quality impacts should be considered in the HRA.			

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~~2.6.1.2~~ 2.6.1.1 The consultation highlighted that the HRA should include an assessment of potential effects on European sites including the Humber Estuary Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site.

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2.6.1.2 The Scoping Opinion also required that the spatial scope of the HRA should include a 30 km radius for SACs where bats are a qualifying feature, due to bat foraging distances. However, no SACs designated for their importance for bats were identified within 30 km of the Order Limits and this matter was not assessed further.

~~2.6.1.3~~ 2.6.1.3 Additional consultation with Natural England have been ongoing throughout the Examination ~~in Public~~ process. Details of the written representations made by Natural England and the Applicant's responses along with dates of engagement will be set out in the Statement of Common Ground (SoCG) being developed with Natural England.

3. APPROACH TO ASSESSING THE EFFECTS ON HABITATS AND SPECIES FROM EMISSIONS TO AIR

3.1 Guidance

~~3.1.1.1~~ 3.1.1.1 The approach to the assessment has taken account of the following guidance:

- DEFRA / EA guidance on Air Emissions Risk Assessment for Your Environmental Permit (as updated on 7 October 2020).
- DEFRA/ EA guidance on Environmental Permitting: Air Dispersion Modelling Reports (as updated on 19 January 2021).
- A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.0, June 2019). Institute of Air Quality Management (IAQM).
- CIEEM (2021) *Advice on Ecological Assessment of Air Quality Impacts.* Chartered Institute of Ecology and Environmental Management. Winchester, UK.
- Natural England Internal Guidance (2018) Approach to advising competent authorities on Road Traffic Emissions and HRAs V1.4 Final. NE.

~~3.1.1.2~~ 3.1.1.2 Information about the relative sensitivity of qualifying interest habitats and plant species, and habitats supporting qualifying interest fauna species, was obtained from the Air Pollution Information System (APIS)[18].

3.2 Critical Loads and Levels

~~3.2.1.1~~ 3.2.1.1 The critical loads[19] and critical levels[20] for each habitat type were obtained from APIS and used as tools to assess the potential for effects of air pollutants on habitats. The critical load refers to the quantity of pollutant deposited from air to the ground, while the critical level is the gaseous concentration of a pollutant in the air.

~~3.2.1.2~~ 3.2.1.2 Effects resulting from nitrogen and acid deposition have been assessed on a habitat and species-specific approach against critical loads listed in APIS. These specific loads are provided in the relevant tables in the Screening of Likely Significant Effects (see Section 04.~~3.1.3~~).

3.2.1.3 Critical levels (for the effects of NO_x, SO_2, NH_3 and HF) have been assessed against environmental standards that apply either across all habitat types (for NO_x and HF), or across lichens/bryophytes and vascular plants (for SO_2 and NH_3) as set out in Table 2. The original HRA assessed daily NOx (24 hrs) against the standard of 75 µg m^{-3}. This updated HRA report has assessed short-term NOx against a standard of 200 µg m^{-3}. The use of the higher standard is set out in the 2020 IAQM guidance (air-quality-impacts-on-nature-sites-2020.pdf (iaqm.co.uk) - see extract below).

"The WHO guidelines include a short term (24-hour average) NOx critical level of 75 µg/m3 . Originally set at 200 µg/m3 as a four-hour mean, the more detailed CD-ROM version of the 2000 WHO guidelines comments: "Experimental evidence exists that the CLE decreases from around 200 µg/m3 to 75 µg/m3 when in-combination with O3 or SO2 at or above their critical levels. In the knowledge that short-term episodes of elevated NOx concentrations are

[18] Air Pollution Information System | Air Pollution Information System (apis.ac.uk) – accessed up to March 2023.

[19] Critical Loads are defined as: "a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"

[20] Critical levels are defined as "concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge".

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generally combined with elevated concentrations of O3 or SO2 , 75 µg/m3 is proposed for the 24 h mean." Ozone and SO2 concentrations are typically low in the UK compared to many other countries. If a regulator does require the use of the short-term NOx critical level, given the low UK SO2 concentrations IAQM consider it is most appropriate to use 200 µg/m3 as the short-term critical load."

~~3.2.1.3~~

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Table 2: Emissions and Relevant Environmental Standards

Substance	Emission Pperiod (Means)	StandardTarget (mean))
NOx	Annual	30 micrograms per cubic metre (µg m^{-3})
	Daily ~~(24hr mean)~~	75 µg m^{-3} / 200 µg m^{-3}
SO_2	Annual	10 µg m^{-3} – where lichens / bryophytes are present
	Annual	20 µg m^{-3} – for all other vegetation
NH_3	Annual	1 µg m^{-3} – where lichens / bryophytes are present
	Annual	3 µg m^{-3} – for all other vegetation
HF	Weekly	0.5 µg m^{-3}
	Daily	5 µg m^{-3}

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3.3 European Sites Search Area

~~3.3.1.1~~ 3.3.1.1 Potential effects on habitats within 15 km of the main emission source at the ERF have been assessed, as recommended by Natural England (see Table 1). This is in line with current Defra / Environment Agency (EA) guidance[21] for some larger emitters.

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~~3.3.1.2~~ 3.3.1.2 European designated sites included in the search area were:

- SAC and candidate SACs;
- SPAs and potential SPAs; and
- Ramsar sites.

3.4 Screening Methodology

~~3.4.1.1~~ 3.4.1.1 The Process Contribution (PC) is the environmental concentration at a receptor location of each substance emitted to air as a result of the Project.

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~~3.4.1.2~~ 3.4.1.2 Atmospheric dispersion modelling was undertaken to predict the short and long-term PC against the respective environmental standards. The screening approach to determine whether the PCs for the Project were insignificant, or required further assessment, was undertaken by comparing the PCs, and where necessary Predicted Environmental Contributions (PECs), against the percentages of the critical levels / loads for each habitat as set out in the Defra / EA guidance ~~(Table 3~~).

~~3.4.1.3~~ 3.4.1.3 The approach also takes account of the contribution of the Project along with other projects and plans as part of the in-combination assessment (Section 4.6).

[21] Air emissions risk assessment for your environmental permit (2016).

Table 3: Assessment Criteria for Habitats and Species

Criterion	Assessment
Long Term / Short Term	
▪ PC < 1% of CL (long) and / or PC <10% of CL (short) ▪ Or PC > 1% of CL (long) and / or >10% of CL (short) but PEC < 70% of CL	▪ Insignificant contribution[22] and no further assessment required. Considered in the assessment to have no likely significant effect.
▪ PC > 1% of CL (long) and / or >10% of CL (short) and PEC > 70% of CL	▪ Cannot be considered as an insignificant contribution. Further assessment is required to determine the effects on habitats and species and whether, or not, they are likely to have an adverse effect on the integrity of a European site.

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3.4.1.4

~~3.4.1.4~~ The levels and loads of air pollutants at habitats in the European sites within a 15 km radius from the main emission source at the ERF were predicted by the atmospheric dispersion modelling. Details about the model and its input data can be found in ES Chapter 5 Air Quality (**Document Reference 6.2.5**).

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~~3.4.1.5~~ 3.4.1.5 To assess the likely effects on European designated sites, the following methods were followed:

- Habitats that were not sensitive to specific air pollutants were screened out.
- Account was taken at this stage of the sensitivity of faunal species to potential effects on their supporting habitat. For example, APIS confirms that the qualifying interest bird species of the Humber Estuary SPA are not sensitive to the effects of acid deposition on their broad habitat types, so effects on these species were not considered further.
- Where qualifying interest features were present only in locations where they would clearly not be affected, they were excluded from consideration.
- In terms of nitrogen and acid deposition, the most sensitive habitat type amongst the qualifying interest features was selected on a ~~worst case~~worst-case basis. If the effects on this habitat type were found to be insignificant, it was assumed that effects on other qualifying features (with less stringent critical loads) would be similarly insignificant.
- Where the most sensitive qualifying interest feature of a designated site could not be screened out, the PCs were then predicted at other less sensitive habitats to assess the potential effect on all relevant habitats associated with the site.
- Where there were no identified critical loads on APIS, a view was taken on how likely the feature was to be affected and the likelihood of a real risk occurring as a result of the effects of air pollutants. For example, in the case of water-based features, the nutrient nitrogen will be influenced overwhelmingly by waterborne nutrient loadings and agricultural run-off rather than by deposition from the atmosphere, so these features were screened out.
- The APIS tool does not cover Ramsar sites. As the Humber Estuary Ramsar site protects the same habitats and species as the SAC and SPA designations, it was assumed that the modelling results for the SAC and SPA could be similarly applied to the Ramsar designation too.
- Predicted levels and loads on some designated sites could not be screened out through the approach above. In many cases, this was due to a number of overlying worst case

[22] The term 'significant' is used here in the context of its meaning within the Environment Agency guidance (i.e. making a 'significant contribution') and not within the context of the EIA Regulations 2017 (i.e. not necessarily leading to a 'likely significant effect').

assumptions around for example, the use of emission limits, modal split of traffic, comparison with the minimum range value of the ~~reh~~ critid~~d~~cal load. As a result a Reasonable Operating Case (ROC) was drawn up (see Appendix 1~~ity~~) and the screening assessment revisited. Updated modelling results for the ROC are presented where appropriate to inform the revised assessment.

3.5 Appropriate Assessment Methodology

~~*3.5.1.1*~~ 3.5.1.1 Where European sites could not be screened out (including taking account of the in-combination assessment), further consideration was given to whether adverse effects on the integrity of the site were likely.

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~~*3.5.1.2*~~ 3.5.1.2 The analysis of the effects on site integrity was based on the effects of air emissions on particular habitats and the conservation objectives of each site. This analysis relied on professional judgement as there are no published criteria to determine whether a PC > 1% / PEC > 70% will result in an adverse effect on the integrity of a European site. The assessment took account of the factors listed below.

- The extent to which the PC was greater than 1% of the critical level / load.
- The background level of each pollutant and the PEC (i.e. PC + background) and whether the background levels / loads were sufficiently low to accommodate the predicted PC loads. As with the PC, there are no published criteria to determine whether a PEC of any level will be insignificant, or result in an adverse effect.
- The location of the relevant qualifying interest feature within the designated site, the extent of this feature affected by PCs > 1% and the variability in the occurrence of PCs > 1% over that area.
- The sensitivity within a habitat type. For example, saltmarsh that is exposed for longer periods (e.g. mature upper saltmarsh) is likely to be more sensitive to effects from pollutant concentrations in the air than those parts of the saltmarsh that are subject to regular inundation by water (e.g. lower to middle saltmarsh).
- The effects of Keadby 2 and Keadby 3 were considered in-combination.

4. SCREENING FOR SIGNIFICANT EFFECTS ON EUROPEAN SITES

4.1 Overview

~~4.1.1.1~~ 4.1.1.1 This section sets out the European sites included in the assessment, the habitats and species that have been screened out, potential effects and the screening for any likely significant effects on the European sites.

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4.2 European Sites

~~4.2.1.1~~ 4.2.1.1 No European sites will be directly affected by the Project. Five European sites were identified within 15 km of the main emission source at the ERF, namely:

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- Humber Estuary Special Area of Conservation (SAC);
- Humber Estuary Special Protection Area (SPA);
- Humber Estuary Ramsar site;
- Thorne Moor SAC; and
- Thorne & Hatfield Moors SPA.

~~4.2.1.2~~ 4.2.1.3 Further details about these European sites are provided in Table 4~~Table 4~~ and their locations are shown in Appendix 3~~Figure 4~~. The qualifying features for each site are summarised in ~~Table 5~~.

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~~4.2.1.3~~ 4.2.1.4 The Humber Estuary SAC and Ramsar boundaries along the River Trent lie adjacent to the Order Limits of the Project around the Flixborough Industrial Estate. The elements of the Project that abut the boundary in this area are the existing port (Flixborough Wharf) and land to be used as a wetland/SUDs area, or other planted landscape screening mitigation, if required.

~~4.2.1.4~~ 4.2.1.5 The presence of Hatfield Moor SAC just outside of the 15 km radius from the main emission source search area was noted during consultation. However, the air quality modelling showed that there was no potential for a significant effect on a site over 15 km from the ERF, so Hatfield Moor SAC was screened out and not considered further.

Table 4: European Sites

European Site Name, Site Code and Area	Distance from ERF stack (km)	Qualifying Features of Interest (Species and Annex I Habitats)	Link to Citation and Conservation Objectives
Humber Estuary SAC (UK0030170) 36657.15 ha	0.1 km west	**Annex I habitats that are a primary reason for selection of the site:** H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide **Annex I habitats and Annex II species present as a qualifying feature, but not a primary reason for site selection:** H1110: Sandbanks which are slightly covered by sea water all the time H1150: Coastal lagoons H1310: *Salicornia* and other annuals colonising mud and sand H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H2110: Embryonic shifting dunes H2120: Shifting dunes along the shoreline with *Ammophila arenaria* (marram grass) ("white dunes") H2130: Fixed coastal dunes with herbaceous vegetation ("grey dunes") H2160: Dunes with *Hippophae rhamnoides* (sea buckthorn) S1095: Sea lamprey (*Petromyzon marinus*) S1099: River lamprey (*Lampetra fluviatilis*) S1364: Grey seal (*Halichoerus grypus*)	European Site Conservation Objectives for Humber Estuary SAC - UK00300170 (naturalengland.org.uk)
Humber Estuary Ramsar (UK11031) 37987.8 ha	0.1 km west	Near natural estuary, supporting dune systems, estuarine waters, intertidal mud and sand flats, saltmarshes and saline lagoons. The Humber Estuary supports a breeding colony of grey seals at Donna Nook and a breeding site for natterjack toad in the dune slacks at Saltfleetby-Theddlethorpe. It is an important migration route for river and sea lamprey and supports an assemblage of waterfowl of international importance. Individual water bird qualifying species are: common shelduck (*Tadorna tadorna*), golden plover (*Pluvialis apricaria*), red knot (*Caladris canutus*), dunlin (*Caladris alpina*), black tailed godwit (*Limosa limosa*), bar-tailed godwit (*Limosa lapponica*) and common redshank (*Tringa totanus*).	Humber Estuary | Ramsar Sites Information Service
Humber Estuary SPA (UK9006111)	6.5 km north	**Annex I Species:** avocet (*Recurvirostra avosetta*), great bittern (*Botaurus stellaris*), hen harrier (*Circus cyaneus*), golden plover, bar-tailed godwit, ruff (*Philomachus pugnax*), Eurasian marsh harrier (*Circus aeruginosus*) and little tern (*Sterna albifrons*).	European Site Conservation Objectives for Humber Estuary SPA - UK9006111 (naturalengland.org.uk)

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European Site Name, Site Code and Area	Distance from ERF stack (km)	Qualifying Features of Interest (Species and Annex I Habitats)	Link to Citation and Conservation Objectives
37630.24 ha		**Regularly Occurring Migratory Species:** common shelduck, knot, dunlin, black tailed godwit and redshank. **Waterbird Assemblage:** 153,934 individual waterbirds (non-breeding) including pink-footed goose *(Anser brachyrhynchus)*, dark-bellied brent goose (*Branta bernicla bernicla*), shelduck, wigeon (*Anas penelope*), teal (*Anas crecca*), mallard (*Anas platyrhynchos*), pochard (*Aythya ferina*), scaup (*Aythya marila*), goldeneye (*Bucephala clangula*), great bittern, oystercatcher (*Haematopus ostralegus*), avocet, ringed plover (*Charadrius hiaticula*), golden plover, grey plover (*Pluvialis squatarola*), lapwing (*Vanellus vanellus*), knot, sanderling (*Calidris alba*), dunlin, ruff, black-tailed godwit, bar-tailed godwit, whimbrel (*Numenius phaeopus*), curlew (*Numenius arquata*), redshank, greenshank (*Tringa nebularia*) and turnstone (*Arenaria interpres*).	
Thorne Moor SAC (UK0012915) 1911.02 ha	10.1 km west	**Annex I habitats that are a primary reason for selection of the site:** 7120: Degraded raised bogs still capable of natural regeneration	European Site Conservation Objectives for Thorne Moor SAC - UK0012915 (naturalengland.org.uk)
Thorne & Hatfield Moors SPA (UK9005171) 2449.2 ha	10.1 km west	**Annex I Species:** European nightjar (*Caprimulgus europaeus*) - breeding	European Site Conservation Objectives for Thorne & Hatfield Moors SPA - UK9005171 (naturalengland.org.uk)

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~~4.2.1.5~~ 4.2.1.6 In general, the conservation objectives seek to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status (FCS) of its qualifying features, by maintaining or restoring:

- the extent and distribution of qualifying natural habitats and habitats of qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of qualifying species; and
- the distribution of qualifying species within the site.

~~4.2.2~~4.2.1 Review of Qualifying Interest Location and Sensitivity to Air Emissions

~~4.2.2.1~~ 4.2.2.1 The air quality modelling approach for nitrogen and acid deposition is habitat-specific. The locations of qualifying interest habitats and species were reviewed for the larger designated sites. Where features were only present at considerable distances from the Project they were screened out of the assessment.

~~4.2.2.2~~ 4.2.2.2 For the Humber Estuary SAC / Ramsar site, many of the qualifying habitats and species are coastal or marine features, which do not occur within 15 km of the Project (where the potential for adverse effects has been identified). All the SAC / Ramsar dune habitats, coastal lagoons, Salicornia and other annuals colonising mud and sand, and grey seal *(Halichoerus grypus*) habitats all occur in the outer estuary at least 45 km from the Project and were therefore screened out. The Ramsar designation included a breeding site for natterjack toads on dune slacks which was also excluded due to distance.

~~4.2.2.3~~ 4.2.2.3 Review of the Humber Estuary SAC citation and the distribution of priority habitats shown on the MAGIC website[23] established that the qualifying habitats and species that occur within 15 km of the Project are:

- estuaries and their component Atlantic salt meadows (saltmarsh);
- mudflats and sandflats not covered by seawater at low tide;
- sandbanks which are slightly covered by seawater all the time;
- river lamprey (*Lampetra fluviatilis*); and
- sea lamprey (*Petromyzon marinus*).

~~4.2.2.4~~ 4.2.2.4 The qualifying interest habitats and species were then reviewed using information from APIS to establish their sensitivity to atmospheric pollutants. Estuaries and Atlantic salt meadows (saltmarsh) were identified as sensitive to nitrogen deposition, but were not sensitive to acid deposition.

~~4.2.2.5~~ 4.2.2.5 For flowing water habitats, or habitats that are regularly inundated with water in the Humber Estuary SAC and Ramsar site, the nutrient nitrogen and acidity inputs will be predominantly from waterborne sources and agricultural run-off rather than air pollutants[24].

[23] Based on citation information and spatial data showing the distribution of designated habitats on the MAGIC website.

[24] APIS notes that 'In most lowland rivers and burns, nitrogen inputs from catchment land-use, not deposition from the atmosphere, are likely to be much more significant'.

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APIS confirms that 'sandbanks which are slightly covered by seawater all the time' are not considered to be sensitive to any of the pollutants in the assessment, therefore effects on this habitat type were screened out. 'Mudflats and sandflats not covered by seawater at low tide', and river / sea lamprey do not have sensitivity information or CLs on APIS. However, as mudflats are regularly inundated with water and lamprey use freshwater and marine habitats, 'mudflats and sandflats not covered by seawater at low tide' and river / sea lamprey are not considered sensitive to airborne air pollutants and have been screened out. This approach has previously been agreed with the EA and Natural Resources Wales (NRW) on submissions for other developments which have subsequently been approved.

4.2.2.6 Key impacts on river and sea lamprey include river pollution, engineering works that can create obstacles to upstream migration (e.g. dams, weirs) and destruction of their spawing gravels and other habitat[25].

4.2.2.7 ~~As t~~The River Trent will ~~not~~ be affected only by ~~the Project except for~~ a slight increase in boat traffic movement due to the Project. The Project will not represent a new source of impact, but will add (potentially) to any impacts from the existing level of vessel movements on the River Trent. Over the years 2000 to 2019 vessel movements ranged between 999 and 2,637 (see Table 3.2 of ES Annex 6: Navigation Risk Assessment, APP-073, noting 2020 value omitted as likely to have been an artefact of the COVID pandemic). The numbers have declined in recent years ranging between 999 and 1,216 over the past five years. In theory the Project could result in 580 additional vessel movements at Flixborough wharf per year (APP-073, Section 7.1). The total (Project plus more recent baseline) number of movements would be comfortably within the recent (past 20 years) baseline levels of vessel movements along the River Trent. It is reasonable to assume that even should the scientific evidence base suggest potential effects on lamprey as a result of vessel passage, that effects against background fluctuations would be indiscernible.~~, no potential effects on river or sea lamprey are predicted and disturbance to lamprey species was screened out of the assessment.~~

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~~4.2.2.6~~ 4.2.2.8 The existing access road to the Flixborough Industrial Estate along Stather Road, adjacent to the River Trent embankments on its eastern side, will be stopped up. It will be replaced by a new access road that is located over 200 m east of the designated sites. In accordance with NE's guidance (June 2018 – see Section 3.1), roads at such a distance do not present *"…a credible risk of a significant effect which might undermine a site's conservation objectives"*. Given the above, significant impacts from construction / operational traffic are not predicted either alone or in combination with other project emissions and this has been excluded from further assessment.

~~4.2.2.7~~ 4.2.2.9 For the Humber Estuary SPA / Ramsar site and Thorne & Hatfield Moors SPA, acid deposition is not expected to have a negative effect on any of the qualifying bird species. In all cases, APIS confirmed that the birds' broad habitat types were not sensitive to acid deposition, or there were no expected negative effects on the species as a result of effects on the species' broad habitat type. However, a number of the qualifying bird species of the SPAs were sensitive to the potential effects of nitrogen deposition on their broad habitat types so the effects of nitrogen deposition were assessed further.

~~4.2.2.8~~ 4.2.2.10 The degraded raised bog habitat at Thorne Moor SAC is sensitive to both nitrogen and acid deposition so the effects of these emissions were assessed further.

~~4.2.2.9~~ 4.2.2.11 In summary, the sensitive qualifying interest habitats and species for each designated site that were taken forward for assessment of the effect of emissions to air are listed in Table 5.

[25] Maitland, P.S. (2003) *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Table 5: Sensitive Qualifying Interest Features

Designated Site	Qualifying Annex I Habitats and Annex II Species	Sensitive to nitrogen (APIS)?	Sensitive to acidity (APIS)?
Humber Estuary SAC / Ramsar	Estuaries	✓	×
	Atlantic salt meadows	✓	×
Humber Estuary Ramsar	Birds species including black tailed godwit & golden plover	✓	×
Humber Estuary SPA	Bird species including avocet, black tailed godwit, curlew, dark-bellied brent goose, golden plover, great bittern, little tern, marsh harrier & wigeon	✓	×
Thorne Moor SAC	Degraded raised bogs still capable of natural regeneration	✓	✓
Thorne & Hatfield Moors SPA	European nightjar	✓	×

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4.3 Effects Considered in the Assessment

~~4.3.1.1~~ 4.3.1.1 The potential effects on European sites due to the construction and / or operation of the Project considered in the assessment include:

- the effect of operational emissions to air;
- disturbance or displacement of qualifying interest bird species from the Humber Estuary Ramsar site;
- disturbance or displacement of qualifying interest bird species from the Humber Estuary SPA using functionally linked land;
- recreational disturbance;
- impacts on lamprey species in the River Trent;
- changes to water quality; and
- changes to air quality during construction.

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~~4.3.1.2~~ 4.3.1.2 Decommissioning activities will be similar in approach and scale to construction activities. Therefore the assessment of construction effects in this report will also be applicable to the decommissioning phase.

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~~4.3.1.3~~ 4.3.1.3 These potential effects are considered in more detail in the following sections.

4.4 Screening of Emissions to Air – Project Alone

4.4.1 Overview

~~4.4.1.1~~ 4.4.1.1 This section summarises the predicted effects of the air pollutants from the Project alone on the European designated sites and whether *"no likely significant effect"* can be concluded, or whether further assessment (i.e. AA) is required.

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4.4.1.2 A summary of the PCs, and where necessary PECs, as a percentage of the critical levels / loads for each designated site is presented. For nutrient nitrogen and acid deposition, only the qualifying interest habitats and species that are sensitive to the effects of these emissions are listed Section 4.2.1~~4.2.2~~). The air dispersion modelling results that informed the HRA report at the time of application are described further in ES Chapter 5 Air

Quality (**Document Reference 6.2.5**) and updates based on the Reasonable Operating Case (ROC) are included in this report as necessary.

~~4.4.1.2~~

4.4.2 *Effects of NO_x on European Sites*

~~4.4.2.1~~ 4.4.2.1 The predicted PCs for long-term (annual mean) and short-term (24 hour) NO_x are listed in Table 6~~Table 6~~.

~~4.4.2.2~~ 4.4.2.2 At the Humber Estuary SAC / Ramsar and SPA, the long-term environmental standard was exceeded (annual PC was > 1% of the critical level), but the PEC, taking account of background levels, was well below 70% of the critical level. The levels for the ROC further reduced the percentages. Therefore, the emissions from the Project alone were ~~still~~ considered to be insignificant according to the assessment criteria. Consequently, no likely significant effects on the Humber Estuary SAC, Ramsar site or the Humber Estuary SPA are expected as a result of annual NO_x emissions.

~~4.4.2.3~~ 4.4.2.3 The PC was < 1% of the critical level (for annual mean) at Thorne Moor SAC and Thorne & Hatfield Moors SPA indicating that emissions of NO_x are insignificant at these sites.

4.4.2.4 For 24 hr NO_x, the data for the original submission showe~~d~~s that the PC wa~~s~~is > 10% of the critical level at the Humber Estuary SAC and Ramsar site, therefore effects could not ~~annot~~ be screened out as insignificant.

~~4.4.2.4~~ 4.4.2.5 ~~and f~~Further assessment was undertaken ~~using the ROC~~using the higher standard for NOx 24 hr which found ~~. This assessment found~~ the PC ~~to~~ comprised only 8.8% of the critical level and hence it too could now be screened out.~~is required. Levels are insignificant (PC < 10% of the critical level) at the other European sites.~~

Table 6: Predicted PCs for NO_x and Percentages of Critical Levels

European Site	Baseline NO_x ($\mu g\ m^{-3}$)	Critical Level ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	PC as % of Critical Level	PEC as % of Critical Level
NO_x Annual Mean					
Humber Estuary SAC, Ramsar	~~13.5~~	~~30~~	~~2.0~~	~~6.8%~~	~~51.7%~~
Multiple Worst Cases (Original HRA)	13.5	30	2.0	6.8%	51.7%
Reasonable Operating Case	13.5	30	0.91	3.03	48%
Humber Estuary SPA	~~13.5~~	~~30~~	~~0.3~~	~~1.0%~~	~~45.9~~
Multiple Worst Cases (Original HRA)	13.5	30	0.3	1.0%	45.9
Reasonable Operating Case	13.5	30	0.27	0.89	-
Thorne Moor SAC	13.2	30	0.03	0.1%	-
Thorne & Hatfield Moors SPA	12.9	30	0.03	0.1%	-
NO_x 24hr					

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European Site	Baseline NO_x (µg m^{-3})	Critical Level (µg m^{-3})	PC (µg m^{-3})	PC as % of Critical Level	PEC as % of Critical Level
Humber Estuary SAC, Ramsar	~~27.0~~	~~75~~	~~36.5~~	~~48.7%~~	~~N/A~~
Multiple Worst Cases (Original HRA)	27.0	75	36.5	48.7%	N/A
Reasonable Operating Case	27.0	200	17.58	8.8%	
Humber Estuary SPA	27.0	75	3.0	4.0%	N/A
Thorne Moor SAC	26.4	75	1.1	1.5%	N/A
Thorne & Hatfield Moors SPA	25.8	75	1.1	1.5%	N/A

The PC is considered to be an insignificant contribution where:
- For NO_x Annual Mean: PC < 1% of CL and / or PC > 1% but PEC < 70% of CL
- For NO_x 24hr: PC < 10% of CL (short term)

4.4.3 *Effects of Ammonia on European Sites*

~~4.4.3.1~~ 4.4.3.1 The predicted PCs for ammonia (NH_3) are listed Table 7~~Table 7~~.

~~4.4.3.2~~ 4.4.3.2 The critical levels used are those for vascular plants (3 µg m^{-3}) for all the European sites except for Thorne Moor SAC, where lichens are present and the more stringent critical level for lichen and bryophyte presence was used (1 µg m^{-3}).

4.4.3.3 Ammonia levels in the previous HRA report assessm~~w~~ent exceeded the percentage PC threshold of 1% and the PEC threshold of 70% of the critical level at the Humber Estuary SAC and Ramsar site, so further screening assessment was undertaken using the ROC~~is required~~. This assessment found the PC to comprise only 0.65% of the critical level and hence on this basis it could be screened out.

~~4.4.3.3~~ 4.4.3.4 Levels are insignificant (PC < 1% of the critical level) at the other European sites and no likely significant effects are expected as a result of emissions of ammonia.

Table 7: Predicted PCs for NH_3 and Percentages of Critical Levels

European Site	Baseline NH_3 (µg m^{-3})	Critical Level (µg m^{-3})	PC (µg m^{-3})	PC as % of Critical Level	PEC as % of Critical Level
Humber Estuary SAC, Ramsar	~~3.6~~	~~3~~	~~0.05~~	~~1.6%~~	~~120.9%~~
Multiple Worst Cases (Original HRA)	3.6	3	0.05	1.61%	120.9%
Reasonable Operating Case	3.6	3	~~XX~~0.02	0.65%	-
Humber Estuary SPA	3.6	3	0.02	0.7%	-
Thorne Moor SAC	2.6	1	0.002	0.2%	-
Thorne & Hatfield Moors SPA	3.5	3	0.002	0.1%	-

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The PC is considered to be an insignificant contribution where:
- PC < 1% of CL and / or PC > 1% but PEC < 70% of CL

4.4.4 Effects of SO_2 on European Sites

~~4.4.4.1~~ 4.4.4.1 The predicted PCs for SO_2 (annual) are listed in Table 8. As for ammonia, the more stringent critical level for lichen or bryophyte presence (10 µg m^{-3} for SO_2) was used at Thorne Moor SAC only, with a critical load of 20 µg m^{-3} applied to all other sites. The PC did not exceed 1% of the critical level at any of the European sites and therefore emissions of SO_2 were considered insignificant. No likely significant effect on the European sites are predicted.

Table 8: Predicted PCs for SO_2 and Percentages of Critical Levels

European Site	Baseline SO_2 (µg m^{-3})	Critical Level (µg m^{-3})	PC (µg m^{-3})	PC as % of Critical Level
Humber Estuary SAC, Ramsar	7.5	20	0.1	0.7%
Humber Estuary SPA	7.5	20	0.1	0.3%
Thorne Moor SAC	1.3	10	0.01	0.1%
Thorne & Hatfield Moors SPA	1.6	20	0.01	0.03%

The PC is considered to be an insignificant contribution where:
- PC < 1% of CL and / or PC > 1% but PEC < 70% of CL

4.4.5 Effects of HF on European Sites

~~4.4.5.1~~ 4.4.5.1 The predicted PCs for short-term hydrogen fluoride (HF) at the European sites are listed in Table 9~~Table 9~~. The PC was < 10% of the critical level for both weekly and 24 hr emissions (both considered to be short term). Therefore emissions of HF are considered to be insignificant and no likely significant effects on the European sites are expected.

Table 9: Predicted PCs for HF and Percentages of Critical Levels

European Site	Baseline HF (µg m^{-3})	Critical Level (µg m^{-3})	PC (µg m^{-3})	PC as % of Critical Level
HF Weekly				
Humber Estuary SAC, Ramsar	3.6	0.5	0.04	7.7%
Humber Estuary SPA	3.6	0.5	0.01	1.3%
Thorne Moor SAC	3.2	0.5	0.002	0.3%
Thorne & Hatfield Moors SPA	3.2	0.5	0.002	0.3%

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European Site	Baseline HF (µg m^{-3})	Critical Level (µg m^{-3})	PC (µg m^{-3})	PC as % of Critical Level
HF 24hr				
Humber Estuary SAC, Ramsar	3.6	5	0.1	1.9%
Humber Estuary SPA	3.6	5	0.02	0.4%
Thorne Moor SAC	3.2	5	0.01	0.1%
Thorne & Hatfield Moors SPA	3.2	5	0.01	0.1%

The PC is considered to be an insignificant contribution where:

- PC < 10% of CL (short term)

4.4.6 Effects of Deposited Nitrogen on European Sites

~~4.4.6.1~~ 4.4.6.1 The predicted PCs for deposited nitrogen are listed in ~~Table 7~~Table 10~~Table 10~~. The PC exceeded 1% of the critical load and the PEC exceeded the 70% threshold for Atlantic saltmeadow (saltmarsh) and estuary habitat types at the Humber Estuary SAC / Ramsar site, so further screening assessment was undertaken using the ROC. This assessment found the PC to comprise only 0.96% of the critical level and hence on this basis has been it ~~could be s~~screened out~~.therefore further assessment is required~~.

~~4.4.6.2~~ 4.4.6.2 Contributions of nutrient nitrogen are insignificant (PC < 1% of the critical load) at all other European sites and no likely significant effects are expected.

4.4.7 Effects of Acid Deposition on European Sites

~~4.4.7.1~~ 4.4.7.1 Thorne Moor SAC was the only European site with qualifying interest features located within 15 km of the Project that was identified as sensitive to acid deposition.

~~4.4.7.2~~ 4.4.7.2 The predicted PCs for acid deposition at Thorne Moor SAC are listed in Table 11~~Table 11~~ The PC did not exceed 1% of the critical load and therefore the effects of acid deposition on the SAC were considered insignificant. No likely significant effects on Thorne Moor SAC are predicted.

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Table 10: Predicted PCs for Deposited Nitrogen and Percentages of Critical Loads

European Site	Qualifying Interest Feature	Background Nitrogen Deposition (kg N /ha /yr)	Critical Load (CL) (kg N/ha /yr) (min)		PC (kg N /ha /yr)	PC as % of CL (min)		PEC as % of CL	
			Min	Max		Min2.3% 0.7%	0.9% 0.3% 0.3%Max	Min	Max
Humber Estuary SAC, Ramsar	Atlantic salt meadows Estuaries	28.9	20		0.5				
Multiple Worst Cases (Original HRA)	Atlantic salt meadows Estuaries	28.9	20	30	0.5	2.3%	1.5%	146.8%	98%
Reasonable Operating Case	Atlantic salt meadows Estuaries	28.9	20	30	XXX0.19	0.96%	0.64%	-	-
Humber Estuary SPA	Pioneer, low-mid and mid-upper saltmarshes supporting a wide range of wetland bird species. Low and medium altitude hay meadows – golden plover, curlew, ruff, wigeon, lapwing, teal, oystercatcher & redshank.	28.9	20	30	0.1	0.70%	0.46%	-	-
	Rich fens supporting hen harrier, great bittern, marsh harrier.	28.9	15	30	0.1	0.93%	0.46%	-	-
Thorne Moor SAC	Degraded raised bogs still capable of natural regeneration.	21.3	5	10	0.01	0.27%	0.13%	-	-

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Thorne & Hatfield Moors SPA	~~Coniferous woodland and d~~Dwarf shrub heath supporting European nightjar	46.2	105	20	0.01	0.13%	0.07%	-	-

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Table 11: Predicted PCs for Acid Deposition and Percentages of Critical Loads

European Site	Qualifying Interest Feature	Background Acid Deposition (keq ha-1 yr-1)		Critical Load (CL) (keq ha-1 yr-1)			PC (keq ha-1 yr-1)		PC as % of CL (min)
		S baseline	N baseline	CL max S	CL min N	CL max N	Total S	Total N	
Thorne Moor SAC	Degraded raised bogs still capable of natural regeneration	0.2	1.5	0.1	0.3	0.5	0.001	0.001	0.4%

The PC is considered to be an insignificant contribution where:

- PC < 1% of CL and / or PC > 1% but PEC < 70% of CL

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4.4.8 Impacts from Dust

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4.4.8.1 The River Trent section of the Humber Estuary SAC / Ramsar site is adjacent to the Project and within the zone where construction dust impacts may occur (ES Chapter 5 Air Quality, **Document Reference 6.2.5**). In the absence of mitigation, the potential for construction dust resulting in significant effects on the qualifying interest habitats or species of the European site cannot be excluded. Therefore the potential effect of construction dust on the Humber Estuary SAC / Ramsar was assessed in the AA.

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4.5 Screening of Other Effects – Project Alone

4.5.1 ~~Disturbance or Displacement of Qualifying Interest Birds from the~~ Humber Estuary Ramsar site and Functionally Linked Land of the Humber Estuary SPA – Landtake and Effects of Noise and Visual Disturbance

4.5.1.1 The construction of the Project will result in the permanent loss of existing agricultural land to the south of the Flixborough industrial Estate. The areas affected are in locations where mostly either no birds, or only small numbers of birds were recorded along adjacent drains/fields during the wintering / passage bird surveys (see below). The new access road will pass through a field that has supported small number of mallard.

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4.5.1.2 The construction and operation of the Project including ~~will result in increased noise, artificial lighting and human disturbance. There will also be an increase in~~ road and rail traffic, ~~and~~ increased vessel movements along the River Trent will result also in increased noise,. This has the potential to lead to disturbance to, or displacement of, bird species from foraging or roosting habitats. An assessment of artificial lighting and human activities

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4.5.1.3 In addition to the Ramsar site that lies immediately west of the Project area, the assessment has considered *"functionally linked land"* from the SPA that lies ~~The Humber Estuary SPA lies~~ 6.5 km to the north of the Project. This is land outwith the SPA that supports important numbers of ~~However, there is the potential that mobile~~ qualifying interest bird species from the SPA ~~rely on land outwith the SPA boundary~~ for foraging or roosting. ~~Important areas for qualifying birds outside of the SPA designation which support the species in question are referred to as 'functionally linked land'.~~

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~~4.5.1.1~~ 4.5.1.4 An ~~recent~~ NE commissioned report defines functionally linked land as 'areas of land occurring within 20 km of an SPA, that are regularly used by significant numbers of qualifying bird species'[26]. A 'significant number of birds' can be defined as 1% of the qualifying population of the SPA. The latest British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS) report lists the mallard population of the SPA as 1046 individuals (based on a five year average from 2015/16 to 2019/20)[27]. The wintering and migratory survey peak counts of 42 and 45 birds respectively would account for 4% of the SPA population. In total, peak counts of over 10 birds (i.e. over 1% of the SPA population) were recorded on approximately half of all wintering and migratory bird survey visits. Therefore, it has been assumed that the area of the River Trent and its immediate banks adjacent to the Project is functionally linked land for the ~~Humber Estuary~~ SPA ~~and the potential effect on mallard from this area was assessed further in the AA.~~

[26] Bowland Ecology 2021. Identification of Functionally Linked Land supporting SPA waterbirds in the North West of England. NERC361. Natural England
[27] WeBS Report Online.

~~*4.5.1.2*~~ 4.5.1.5 ~~The Extended Phase 1 Habitat surveys established that there is little suitable habitat for qualifying interest bird species within the Order Limits. Habitats include intensively managed arable farmland with associated field drains and hedgerows which provide limited refuge or foraging habitat for the waterbirds listed under the Humber Estuary Ramsar or SPA designation (ES Chapter 10 Ecology and Nature Conservation) (**Document Reference 6.2.10**). The River Trent provides more suitable habitat adjacent to the Project, with the riverside vegetation dominated by reedbeds in this area.~~

~~*4.5.1.3* The breeding,wintering and migratory bird survey results confirmed that the arable farmland habitat is not an important area for most waterbirds. During the breeding bird survey, no bird species from the Ramsar site were recorded. Only small numbers of waterbirds from the Humber Estuary Ramsar were recorded in the arable fields around the Project during the wintering and migratory bird surveys (such as teal, oystercatcher, lapwing, curlew and a single sighting of marsh harrier flying over arable fields). Slightly higher numbers of roosting golden plover were recorded on occasion (with a peak count of 82) within the Order Limits but the majority of observations were of low numbers of birds.~~

The wintering surveys of 2018/19 and 2019/20 and wintering and migratory bird surveys of 2021/22, recorded several wetland bird species associated with the Humber Estuary both along the River Trent and in adjacent fields and drains. These included shelduck, mallard, teal, oystercatcher, golden plover, lapwing, redshank and curlew. ~~also found that the area of the River Trent adjacent to the Project~~ Locations and numbers of these species are shown in Appendix 3 and include birds in flight. Pink-footed geese were observed, but only in flight across the Project area and along the River Trent.

~~4.5.1.6 did not support significant populations of most waterbirds, with only small numbers of birds recorded. The locations of the bird species that are qualifying interests of the Humber Estuary SPA and Ramsar site and the numbers recorded are shown in Figure 0.1 (birds recorded not in flight) and Figure 0.2 (includes birds in flight as well). The records include all those made during the wintering bird surveys of 2018/19 and 2019/20 and the migratory and wintering bird surveys of 2021/22.~~

Most of the records ~~from the wintering / passage surveys~~ were of mallard, a species that occurs on many of the watercourses in the area including the River Trent. The majority of records were of small numbers of birds (ie <10 birds). Larger numbers were typically recorded along the River Trent and its banksides, with the biggest groups (45 birds in September 2021 and 32 in October 2021) recorded on the western banks of the River Trent over 500 m north west of the red line boundary at is closest point.

4.5.1.7 The main records of ~~I~~Lapwings were ~~recorded in the area,~~ of 50 birds (November ~~but predominantly~~ 2018), in agricultural fields north-west of Amcotts village, over 500 m west of the River Trent and groups of 14 – 31 individuals (November / December 2021) in ~~and in~~ agricultural fields closer to Park Ings Farm, in the red line boundary, but some 500 m east of the new access road and over 250 m from ~~a~~ temporary construction laydown areas. Smaller numbers and bird in flight were recorded ~~The records of large groups of lapwing (between 14 and 31 individuals) near Park Ings Farm were observed during the November and December surveys of 2021. The concentration of 50 lapwing in agricultural fields north-west of Amcotts was recorded during one survey (November 2018).~~ further south in the red line boundary and to the north of the Flixborough Industrial Estate.

~~*4.5.1.4*~~ 4.5.1.8 Redshank numbers (all from the 2021 / 2022 survey) were largely of single birds including some inside the red line boundary (e.g./ north of the Flixborough IE, on Lysaght's Drain west of the Skippingdale Retail Park). The largest number (eight birds) was recorded approximately 500 m north of the red line boundary along the Burton and Flixborough Drain.

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Figure 0.1 ~~SPA and Ramsar Birds (Excluding birds in Flight) (Wintering and Migratory Surveys 2018 – 2022)~~

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Figure 0.2 SPA and Ramsar Bird Results – All Records (Wintering and Migratory Surveys 2018 – 2022)

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~~*4.5.1.5 Lapwings were recorded in the area, but predominantly in agricultural fields north-west of Amcotts, over 500 m west of the River Trent and in agricultural fields closer to Park Ings Farm some 500 m east of the new access road and over 250 m from a temporary construction laydown areas. The records of large groups of lapwing (between 14 and 31 individuals) near Park Ings Farm were observed during the November and December surveys of 2021. The concentration of 50 lapwing in agricultural fields north-west of Amcotts was recorded during one survey (November 2018).*~~

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~~4.5.1.9 Redshank numbers (all from the 2021 / 2022 survey) were largely of single birds including some inside the red line boundary (eg north of the Flixborough IE, on Lysaght's Drain west of the Skippingdale Retail Park). The largest number (eight birds) were recorded approximately 500 m north of the red line boundary along the Burton and Flixborough Drain.~~

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~~Numbers of g~~Golden plovers were recorded within the red line boundary in an arable field north of Lysaght's Drain (approximately 400 m east of the new access road and approximately 200 m from the temporary construction compound). Records of small groups of 20-30 birds were recorded between January and March 2022. A larger group of 82 birds was recorded in the same area, but only on one occasion (December 2021). A single record of 290 birds was recorded in flight along the ~~south of Amcotts, along the western banks of the~~ River Trent south of Amcotts (November 2021)~~, approximately 200 m from the red line boundary at its closest point~~.

~~4.5.1.10 There were only two records of teal (three in February 2020 and one in October 2021) both to the west of Skippingdale Industrial Park in Lysaght's Drain and an interconnecting drain.~~

Oystercatchers were recorded either singly or in groups of two, with two records in each of December 2019, Jan/Dec 2020 and March 2022. Records were predominantly outside the red line boundary, either north of the Flixborough IE, or flying along the River Trent. One record was of two birds in the red line boundary, close to the Skippingdale Retail Park.

4.5.1.11 Curlew (two records in Aug/Sept 2021) were all recorded flying south along the River Trent and a single shelduck was recorded flying south over fields north of the red line boundary. Similarly, pink-footed goose was recorded in flight only, both across the Project area and along the River Trent. None was recorded using the Project area, or the immediate surrounds.

4.5.1.12 There were only two records of teal (three in February 2020 and one in October 2021) both to the west of Skippingdale Industrial Park in Lysaght's Drain and an interconnecting drain.

4.5.1.13 To assess the likelihood of significant effects on the birds, considera~~e~~tion has been g~~e~~iven to background levels and a level of 55 dB, that has been used as a reference threshold based on published reviews of the effects of noise on coastal bird species (like those species recorded during the Project surveys). Noise of less than 55 dB (at a bird) were identified as a low-level disturbance stimulus and unlikely to cause a response in wetland bird species in intertidal areas[28].

4.5.1.14 Background noise levels were measured at residential receptors (including in more isolated areas), as part of the data collected for the Environmental Statement (ES).

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[28] Cutts N, Hemingway K & Spencer J (2013) *Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects (Version 3.2)*, University of Hull.

Daytime noise levels recorded in the area around the Project site ranged from 46-62 dB $L_{Aeq,12hr}$ and maximum noise levels ranged from 51-97 dB $L_{Amax,15\ min}$ (see Appendix 3).

4.5.1.15 The predicted distances for unmitigated[29] construction noise to reduce to 55 dB, $L_{Aeq,12\ hr}$[30] around the construction of the main buildings, during concrete breaking and around the railway are listed below and shown in Appendix 3. These figures include noise levels associated with bored piling.

- Main building construction - northern buildings - 359 m.
- Main building construction - southern buildings - 275 m.
- Concrete breaking - 489 m.
- Railway construction work – 158 m.

4.5.1.16

~~Two wintering marsh harriers were recorded foraging over fields north of the red line boundary, one record of which was within approximately 100 m of the north-west corner of the red line boundary at its closest point.~~

~~There is potential for disturbance to these birds during construction and operation of the Project as a result of increased noise. Background noise levels were measured at residential receptors, as part of the data collected for the Environmental Statement (ES). Daytime noise levels recorded in the area around the Project site ranged from 46-62 dB $L_{Aeq,12hr}$ and maximum noise levels ranged from 51-97 dB $L_{Amax,15\ min}$ (see Figure 0.1).~~

~~Figure 0.3 includes contours showing where construction noise levels are predicted to reduce to 55 dB, $L_{Aeq,12\ hr}$. These are based on activities associated with the construction of the main buildings and concrete breaking activities. 55 dB has been used as a reference level based on published reviews of the effects of noise on coastal bird species (like those species recorded during the Project surveys). Noise of less than 55 dB (at a bird) were a low-level disturbance stimulus and unlikely to cause a response in wetland bird species in intertidal areas[31].~~

~~Figure 0.3 shows two predicted noise level contours for each of the building construction and the concrete breaking and include noise levels associated with bored piling. The contours show a range between no mitigation (blue) and a reduction of 10 dB (orange), which is the upper end of what is likely to be achievable (mitigation measures are discussed within the Aproppriate Assessment).~~

~~The predicted distances for unmitigated construction noise to reduce to 55 dB, $L_{Aeq,12\ hr}$ are listed below:~~

~~Main Building Construction~~

~~Unmitigated[32]~~

~~Northern Buildings - 359 m~~

[29] More soft ground has been assumed in the location of the southern buildings and more hard standing assumed in the northern building location. Noise attenuates quicker in areas of soft ground, hence the smaller zone to achieve 55 dB for the unmitigated situation at the southern buildings.

[30] L_{Amax} levels are used typically to assess the effects of noise on birds that result from occasional and often sudden high noise levels. However, the work on the NLGEP is expected to be at amore consistent level with a number of construction activities happening at the same time. Therefore, in this case L_{Aeq} values were considered to be similar to the L_{Amax} levels.

~~[31] Cutts N, Hemingway K & Spencer J (2013) Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects (Version 3.2), University of Hull.~~

~~[32] More soft ground has been assumed in the location of the southern buildings and more hard standing assumed in the northern building location. Noise attenuates quicker in areas of soft ground, hence the smaller zone to achieve 55 dB for the unmitigated situation at the southern buildings. In terms of mitigation, it has been assumed that there is hard ground throughout as, should noise barriers be used, this would raise the effective source height and lessen the attenuation effect of the soft ground.~~

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~~Southern Buildings - 275 m~~

~~Concrete Breaking~~

~~Unmitigated – 489 m~~

~~Finally, it shows the 55 dBL$_{Aeq\ 12\ hr}$ contours predicted for the un-mitigated railway construction (a distance of 158 m from works), as it has yet to be determined if mitigation is practical.~~

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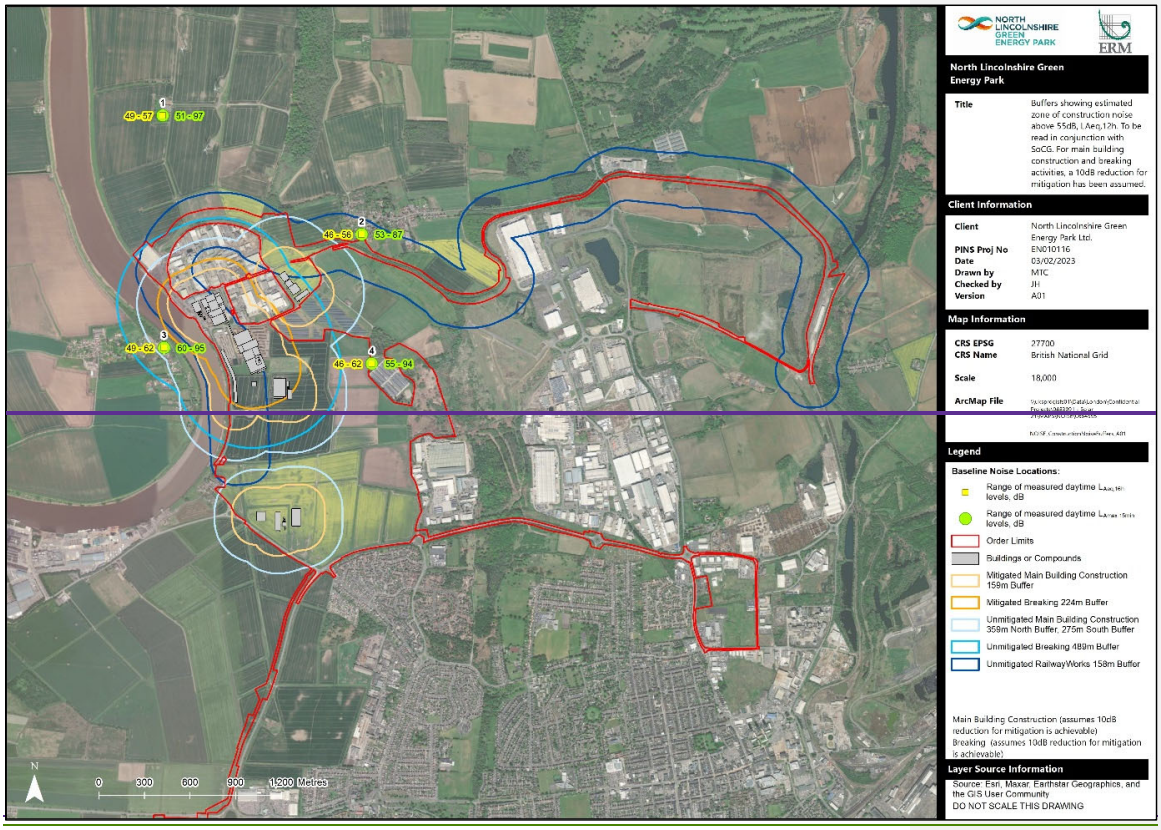

Figure 0.3

Construction Noise Contour Plots

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The ~~contours show that in the unmitigated case,~~ predicted unmitigated noise levels above 55 dB $L_{Aeq,12\ hr}$ are likely to be restricted to within approximately 500 m of the work (see Appendix 3). Comparing this distance with the ~~e~~ bird locations ~~and the predicted noise contours in Figure 0.1 and Figure 0.3~~, it is evident that most of the bird records are in areas where the predicted noise levels are less than 55 $dB_{LAeq\ 12\ hr}$, ~~lie beyond even the unmitigated contours,~~ especially to the north, west and south / south-east. Significant effects on these birds are not predicted. In the absence of mitigation~~.~~, the main effects are likely to be on small numbers of mallard along the River Trent to the west / south-west of the Project area ~~area a~~and these are considered further in the Appropriate Assessment (see Section 5) ~~and cannot be excluded. Therefore, the potential effect on the mallard along the River Trent was assessed further in the AA. There is potential for disturbance to these birds during construction and operation of the Project as a result of increased noise. Background noise levels were measured at residential receptors, as part of the data collected for the Environmental Statement (ES). Daytime noise levels recorded in the area around the Project site ranged from 46-62 dB $L_{Aeq,12hr}$ and maximum noise levels ranged from 51-97 dB $L_{Amax,15\ min}$ (see Figure 0.1).~~

4.5.1.17 The route of the new access road will cross Lysaght's Drain and pass through a field where small numbers of mallard (*e.g.* single birds and a groups of two or three) have been recorded. It is possible that some birds may be disturbed however, significant effects from the landtake or noise are not predicted.

~~*4.5.1.6 A larger sized flock was recorded on only a few occasions.A flock of approximately 50 lapwing were recorded in fields to the west of the River Trent (which will not be affected by the Project) on one survey visit. Golden plover were recorded in larger numbers in flight on one survey (a peak count of 290 birds were observed in flight over the River Trent) but all other observations of golden plover in flight or on land were in much lower numbers.*~~

~~*4.5.1.7 Only small numbers of waterbirds that are qualifying interest features of the Humber Estuary Ramsar designation were recorded. There is potential for disturbance to these birds during construction and operation of the Project, for example as a result of increased noise, lighting, traffic movements and human presence. However, birds using the local area are showing signs already of tolerance to some sources of disturbance, given the existing industrial estate present and regular agricultural activity. If small numbers of birds are disturbed, there are large areas of estuarine and arable farmland habitats available in the local area to move to. Given this and the low numbers of qualifying feature bird species recorded, the effects of disturbance or displacement on birds from the Ramsar designation are not predicted to be significant.*~~

~~***4.5.2 Disturbance or Displacement of Qualifying Interest Birds from the Humber Estuary SPA on Functionally Linked Land***~~

~~*4.5.2.1 The Humber Estuary SPA lies 6.5 km to the north of the Project. However, there is the potential that mobile qualifying interest bird species from the SPA rely on land outwith the SPA boundary for foraging or roosting.*~~

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Important areas for qualifying birds outside of the SPA designation which support the species in question are referred to as 'functionally linked land'.

4.5.2.2 As detailed in the previous section, the breeding and wintering bird surveys highlighted that the arable farmland habitat surrounding the Project is not an important area for waterbirds, with very low numbers of waterbirds recorded. During the wintering and migratory surveys, waterbird species were recorded in low numbers (such as teal, oystercatcher, lapwing, curlew, golden plover and a singletwo sightings of marsh harrier). The only exception to this were occasional sightings of larger flocks of lapwing and golden plover (as detailed previously) and regular records of mallard, which were recorded in larger numbers (with a peak of 41 birds during the wintering survey and a peak of 45 birds during the migratory bird survey). Wintering mallard are a qualifying interest species of the Humber Estuary SPA but are not protected under the Ramsar designation. The mallards were mainly recorded in the water of the River Trent, on its banks or flying over the river, with small number of birds recorded in the adjacent fields. Mallard was the only qualifying interest species recorded on the majority of wintering and migratory bird survey visits rather than occasionally, and in significantly sized numbers throughout the survey visits to suggest that the location may be important for the species.

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4.5.2.3 A recent NE commissioned report defines functionally linked land as 'areas of land occurring within 20 km of an SPA, that are regularly used by significant numbers of qualifying bird species'[33]. A 'significant number of birds' can be defined as 1% of the qualifying population of the SPA. The latest British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS) report lists the mallard population of the SPA as 1046 individuals (based on a five year average from 2015/16 to 2019/20)[34]. The wintering and migratory survey peak counts of 42 and 45 birds respectively would account for 4% of the SPA population. In total, peak counts of over 10 birds (i.e. over 1% of the SPA population) were recorded on approximately half of all wintering and migratory bird survey visits. Therefore, it has been assumed that the area of the River Trent and its immediate banks adjacent to the Project is functionally linked land for the Humber Estuary SPA and the potential effect on mallard from this area was assessed further in the AA.

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4.5.34.5.2 Visual Recreational Disturbance

4.5.2.1 There is the potential for visual disturbance to birds due to the construction and operation of the Project including lighting and from an increase in recreational use. The Project is committed to enabling public access and new cycleways and footpaths will be provided, as well as part of the Project. The Project also includes the the creation of visitor centre linked to a a new wetland area adjacent to the River Trent, which will create new ecologically diverse wetland habitats that will contain informal paths (ES Chapter 3 The Project Description and Reasonable Alternatives) (**Document Reference 6.2.3**).

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4.5.2.2 The wetland will have informal paths and an associated Visitor Centre to encourage public access. The new wetlands area and its use by visitors and operational

[33] Bowland Ecology 2021. Identification of Functionally Linked Land supporting SPA waterbirds in the North West of England. NERC361. Natural England
[34] WeBS Report Online.

~~personnel has been considered as a potential source of impact in the assessment of recreational disturbance.~~ Bird species associated with the designated sites have only been recorded in small numbers close to the main works area, typically to the north of the remaining parts of the Flixborough Industrial Estate and along the River Trent.

~~4.5.3.1~~ 4.5.2.3 The visitor centre location, nearby buildings and wetland area located in areas east of the River Trent where no birds were recorded during the surveys.

~~There is the potential for the increase in recreational use of the site to cause disturbance to qualifying interest bird species of the Humber Estuary Ramsar, or those using functionally linked land associated with the Humber Estuary SPA. However, bird species associated with the designated site have only been recorded in small numbers around the NLGEP site and River Trent, as detailed previously. The raised earth embankments around the River Trent provide some screening of activity to birds on the river.~~It is possible that some disturbance may result to small numbers of birds along the route of t~~In addition, the Applicant has confirmed that th~~e ~~existing access road to the Flixborough Industrial Estate along Stather Road, adjacent to the River Trent embankments on its eastern side, will be stopped up. It will be replaced by a~~ new access road and from works to the new railway along the northern boundary of the Project area. However, given the small numbers of birds recorded, ~~signficinat~~significant effects are not predicted.

4.5.2.4 ~~that is located over 200 m east of the designated sites.~~Visual disturbance to birds on the River Trent from the works is not predicted due a combination of screening from the existing raised earth embankments that align the River Trent (2 – 3 m in height) and the distance of birds from the work that may take place at height on the main part of the construction site and from the access road that will be re-routed 200 m east of the designated sites. Effects on the River Trent from lighting are not predicted due to the control of the light spill through the indicative lighting strategy which is an integral part of the project design. ~~Given the small numbers of Humber Estuary SPA and Ramsar qualifying interest species present in the local area and their likely sensitivity to disturbance, any effects are likely to be temporary and localised. No likely significant effects on the functionally linked land associated with the Humber Estuary SPA, or the Humber Estuary Ramsar site are predicted.~~There is the potential for the increase in recreational use of the site to cause disturbance to qualifying interest bird species of the Humber Estuary Ramsar, or those using functionally linked land associated with the Humber Estuary SPA. However, bird species associated with the designated site have only been recorded in small numbers around the NLGEP site and River Trent, as detailed previously.

4.5.3 Impacts on Lamprey in the River Trent

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4.5.3.1 Whilst no piling is required in the River Trent, consideration was given to the effects of bored piling activity on land as part of the Project and what, if any effect, this may have on lamprey species in the River Trent. Piling will be required to enable construction of the building foundations. The nearest building constructed to the River Trent as part of the Project (the carbon capture building), is over 40 m from the river. All piling used in the foundation creation will be bored piling. There are no plans to use percussive piling and its use is not expected to be necessary, unless in exceptional circumstances (*e.g.* over a few hours maximum to break a blockage).

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4.5.3.2 There is no specific information about the effects of piling on lamprey species, and human perceptions have been used as a proxy. BS 5228 (Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 2 Vibration) suggests that for humans the threshold of perception of vibration is between 0.14 mm s^{-1} (just perceptible in most sensitive situations) and 0.3 mm s^{-1} (just perceptible in a residential environment). Measurements undertaken by ERM close to CFA bored piling activities on another project (for DLR in London) recorded vibration levels of between 0.4 and 1.4 mm s^{-1} at a distance of

3 m. Using the method in BS 5228, the highest measurement is estimated to reduce to below 0.14 mm s^{-1} at a distance of 20 m.

4.5.3.3 Whilst acknowledging that these figures / distances relate to human perception, the River Trent (at its closest point) is located at a considerably greater distance from the piling source as described above. It should be noted also that the river will experience vibration currently from existing industrial activities in the area, including the loading and unloading of steel that currently takes place at Flixborough Wharf.

4.5.3.4 In addition to the above, the technical guidance issued by the California Department of Transportation (Technical Guidance for the Assessment of the Hydroacoustic Effects of Pile Driving on Fish, 2020) is of note also. It highlights the benefits of undertaking piling on land (including more intrusive driven piling) to avoid effects on fish in water (see extract below).

"The most effective option for avoiding and minimizing underwater sound pressure during construction of deep-water foundations for new bridge construction is designing the new foundations to span the wet channel……where it is feasible, land-based pile driving is an excellent approach to avoid and minimize impacts on the environment and greatly reduces the potential for additional mitigation under the CESA that might result from driving within the wet channel. The further away the pile is from the wet channel during construction, the more attenuation would be achieved through transmission loss as the energy from the pile moves through the land toward the wet channel. Although designing a longer bridge span to avoid placing piles in the water may prove more expensive, such a design also reduces off-site mitigation requirements and associated costs often associated with impacts to listed species that may occur when driving in the wet channel."

~~4.5.3.2~~ 4.5.3.5 Hence, the River Trent and the lamprey species it supports are unlikely to be affected significantly by vibration from bored piling and disturbance to lamprey species has been screened out of the assessment.

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4.5.4 Water Quality Impacts

~~4.5.4.1~~ 4.5.4.1 The water quality of the River Trent (part of the Humber Estuary SAC / Ramsar site) will not be directly affected by the Project. The whole of the River Trent along the length of the Order Limits is lined with raised earth embankments which provide flood defence. There will be no abstractions to or discharges from the river. There will be no construction, operational or decommissioning interactions with the River Trent (as detailed in ES Chapter 9 Water Resources and Flood Risk, **Document Reference 6.2.9**).

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~~4.5.4.2~~ 4.5.4.2 The only potential pathway for impact on the Humber Estuary SAC / Ramsar is from surface water as the River Trent is downstream of the Project. In the absence of mitigation, the potential for contaminated surface water entering the watercourse and resulting in significant effects on the qualifying interest habitats or species supported by the River Trent cannot be excluded. Therefore, the potential effect on the Humber Estuary SAC / Ramsar was assessed further in the AA.

~~4.5.5 Air Quality during Construction~~

~~4.5.5.1 The potential effects on air quality during construction were also considered for the Humber Estuary SAC / Ramsar site. The Air Quality assessment concluded that the likely impacts of increased traffic emissions during~~

*construction are negligible and were therefore not considered further (ES Chapter 5 Air Quality, **Document Reference 6.2.5**).*

*4.5.5.2 The River Trent section of the Humber Estuary SAC / Ramsar site is adjacent to the Project and within the zone where construction dust impacts may occur (ES Chapter 5 Air Quality, **Document Reference 6.2.5**). In the absence of mitigation, the potential for construction dust resulting in significant effects on the qualifying interest habitats or species of the European site cannot be excluded. Therefore the potential effect of construction dust on the Humber Estuary SAC / Ramsar was assessed in the AA.*

4.5.64.5.5 Screening Assessment Summary – Project Alone

4.5.5.1 This revised HRA report has taken account of the modelling data for the ROC. As a result, no likely significant effects have been concluded from air emissions for the Project alone on European sites, with all predicted PC levels / loads being <1% of the relevant critical level, or load.

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4.5.6.1 4.5.5.2 *The PCs for all of the pollutant types at Thorne Moor SAC and Thorne & Hatfield Moors SPA are predicted to be insignificant. Therefore, no likely significant effects on these European sites are predicted and no further assessment is required.*

4.5.6.2 The screening assessment could not rule out the potential for significant effects at the Humber Estuary SAC / Ramsar site for the effects of *operational emissions to air (NOx (24 hr), ammonia and nitrogen deposition (for Atlantic salt meadows and estuary habitat types)),* surface water quality and construction dust. In addition, potential disturbance to mallard using functionally linked land associated with the Humber Estuary SPA from noise could not be screened out. All are considered further in the AA.

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4.5.6.3 Therefore further assessment was required for the Humber Estuary SAC / Ramsar and the Humber Estuary SPA as part of the AA.

4.6 In-combination Effects – Screening

4.6.1 Approach to Screening

4.6.1.1 4.6.1.1 The ES sets out the approach to assessing the cumulative effects of the Project in Chapter 18 Cumulative Assessment (**Document Reference 6.2.18**). The same approach has been used to identify plans and projects which may have an in-combination effect on European sites for this HRA. Other developments considered in the assessment included those which are under construction, permitted applications not yet implemented and submitted applications not yet determined.

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4.6.1.2 4.6.1.2 The assessment applied a proportionate approach in identifying other proposed developments that could contribute to impacts on the same receptors as the Project. The spatial scope of each planning category considered is summarised in Table 12 below. The search area was determined by the largest distance at which the Project could potentially have in-combination effects. The key search areas for the HRA in-combination assessment were:

- In terms of emissions to air, it was considered that only developments with significant combustion emissions had the potential to have an effect in-combination with this Project. For air quality impacts on SAC, SPA and Ramsar sites the search area for other developments was a 15 km radius around the main emission source at the ERF, and then a further 15 km radius around European sites that fell within the initial 15 km

radius, as requested by Natural England during consultation (see Section 2.6). For the extensive Humber Estuary SAC / Ramsar site, the search area extended 15 km only from the areas of the designated site that fell within the original 15 km search area; and

- A conservative 2 km search area around the Project Order Limits was applied for construction and operational disturbance or other indirect local effects, plus a further 2 km buffer around those parts of the Humber Estuary SAC / Ramsar falling within the initial 2 km search area.

Table 12: Planning Categories Scale and Spatial Scopes

Category	Spatial Scope
Power generation projects or projects with significant combustion emissions a. NSIP b. Section 36 (including variations) of the Electricity Act c. Town and Country Planning Act (combustion projects only that constituted EIA development under the Town and Country Planning (EIA) Regulations 2017 and required HRA to screening stage at least	15 km from main emission source at the ERF, plus a further 15 km from each European site (SAC / SPA / Ramsar) falling within the initial 15 km
NSIP, Section 36 (including variations), Section 37 of the Electricity Act and Town and Country Planning Act: for projects which, by virtue of their potential to affect (e.g. through disturbance) a European protected site, were screened in to undertake an EIA under the Town and Country Planning (EIA) Regulations 2017	0 to 2 km from the Order Limits, plus a further 2 km from the parts of European sites falling within the initial 2 km zone

4.6.1.3

~~4.6.1.3~~ The cumulative assessment established a long list of 232 developments to be considered, which was then screened to identify a shortlist of developments relevant for the HRA. The full process is detailed in Chapter 18 Cumulative Assessment (**Document Reference 6.2.18**). The screening considered temporal considerations (e.g. whether the construction of other development could overlap in time with the Project construction phase). As a worst-case approach, it was assumed that there will be overlapping operational phases for all the other developments with the operational phase of the Project. Very ~~small-scale~~small-scale developments such as household extensions were screened out. It also considered technical considerations, such as the likely zone of influence (ZoI) for each impact type. In terms of HRA, the main impacts (and their zones of influence) considered are listed in Table 13~~Table 13~~.

Table 13: Project Impacts (and their Zones of Influence) with Potential to Contribute to Cumulative Effects on European Sites

Topic	Potential Impacts	Zone of Influence
HRA: construction	During construction, potential cumulative disturbance effects could occur with other developments being constructed in close proximity.	A conservative ZoI was applied for European sites, comprising up to 2 km from the Order Limits, plus 2 km from the parts of European sites falling within the initial 2 km zone. This zone was considered for impacts such as construction dust and disturbance to qualifying interest species.
HRA: operation	During operation, the key consideration will be the potential combined effect of emissions to atmosphere (from the Project and other combustion processes) and subsequent pollutant deposition on designated sites. Some activities associated with operation could contribute to cumulative effects with other developments in close proximity.	15 km, plus a further 15 km from each European site falling within the initial 15 km zone. Other developments considered are those that are likely to include a significant combustion process. 2 km for local wildlife sites. Up to 2 km from the Order Limits, plus 2 km from the parts of European sites falling within the initial 2 km zone.

4.6.1.4

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~~4.6.1.4~~ The extents of these ZoI are shown on Appendix 3~~Figure 5 and Figure 6~~ along with the developments identified within them. Any developments shown on the Figures but not short-listed in Table 14~~Table 14~~ were not considered to have effects that should be considered for the HRA in-combination screening.

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~~4.6.1.5~~ 4.6.1.5 Consideration of developments with significant operational emissions, a review of other developments with large combustion sources not yet operating, but likely to operate concurrently with the Project, identified the following:

- Keadby 2 (within 15 km);
- Keadby 3 (within 15 km);
- An Energy Recovery Facility at Doncaster (within 15 km of European sites that are within 15 km of the Project); and
- An Energy Centre in Hull (within 15 km of European sites that are within 15 km of the Project).

~~4.6.1.6~~ 4.6.1.6 The locations of these other developments are shown in Appendix 3~~Figure 5~~. Several other developments recently approved were also identified but were screened out of the in-combination effects assessment for the following reasons:

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- Eggborough (within 15 km of European sites that are within 15 km of the Project) is a CCGT to replace a former coal fired generation station of similar size operating until 2018 and assumed to have been contributing to the baseline measurements made in recent years. This development has been screened out as effectively displacing the emissions of a previous similar-sized emitter.
- West Burton (within 15 km of European sites that are within 15 km of the Project) is a 299 MW gas-fired plant which will replace a much larger coal-fired plant scheduled to operate until September 2022. This development has been screened out as effectively displacing the emissions of a larger-sized emitter.
- Drax Repower (within 15 km of European sites that are within 15 km of the Project) is replacing the remaining two coal-fired units with gas turbines[35]. This development has been screened out as effectively displacing the emissions of a previous similar-sized emitter.

~~4.6.1.7~~ 4.6.1.7 On further assessment and review of the planning applications for the Energy Recovery Facility at Doncaster (see BH EnergyGap LLP, 2020)[36] and the Energy Centre in Hull (Energy Works (Hull) Ltd, 2011)[37] it was apparent that each development had assessed its air quality effects to a distance of 10 km from their respective locations. It is reasonable to assume that no air quality impacts were predicted beyond these distances. The Energy Recovery Facility at Doncaster and the Energy Centre in Hull are approximately 13.3 km and 13.9 km away respectively from any parts of European sites that are within 15 km of the Project. On this basis these other developments were screened out of the in-combination effects assessment.

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4.6.1.8 The above screening process left the Keadby 2 and Keadby 3 developments for consideration in the in-combination effects assessment. It should further be noted that Keadby 1 gas-fired power station will cease operating before Keadby 3 is commissioned.

[35] Currently it appears that the Drax Repower project in the form of gas turbines will not proceed and a likely scenario is the existing coal-fired generation will be replace by biomass. Whatever the outcome, in emission terms it will still be a case of effectively displacing the emissions of a previous similar-sized emitter.

[36] BH EnergyGap LLP (2020) Sandall Stones Road, Doncaster – Environmental Statement Volume 1 Chapter 5 Air Quality

[37] Energy Works (Hull) Ltd (2011) Environmental Statement - Air Quality and Odour and Environmental Statement Addendum for an Energy Works on three adjacent parcels of land in Hull (Application 11/00615/CM)

~~4.6.1.8~~ 4.6.1.9 The in-combination assessment takes into account the updated air dispersion modelling of the ROC and for Keadby 2 focuses on the more likely operating scenario of 4000 hrs as modelled at the permit application stage.

Table 14: Short List of Other Developments for Consideration in the HRA

ID	Application Reference	Description of Other Development	Location in relation to Order Limits	Overlap in temporal scope
84	PA/2015/0628	Hybrid application for full planning permission for new road and footpaths, informal areas of open space, parklands, play areas and new wildlife habitats, attenuation ponds, recreational lakes, and wetlands community; and outline planning permission with all matters reserved for non-residential institutions (Use Classes D1 and D2), leisure facilities (Use Classes A1 and A3) and storage (Use Class B8).	Within 100 m	Construction
85	PA/2015/0396	Outline planning permission for the development of up to 2500 new homes including a village centre (Use Classes A1, A2, A3, A4, A5, B1 and D1), a health care facility (Use Class D1), community facilities (Use Class D1), a 3 form of entry primary school (Use Class D1), new roads and footpaths, informal areas of open space, play spaces and new wildlife habitats, water bodies and wetlands with all matters reserved for subsequent approval.	Within 100 m	Construction
86	PA/2015/0627	Planning permission for highway works to deliver the new terminating junction to the M181 motorway (due to the de-trunked section of the highway to the north and south of the terminating junction) and the development of the eastern and western sections of the east west link road connecting to the B1450 Burringham Road.	Within 100 m	Construction
21(2)	PA/2019/1461	Planning permission to site an array of ground mounted photovoltaic solar collectors including associated infrastructure.	Within 100 m	Construction
83	PA/2020/2049	Planning permission for the construction of 163 two, three and four bedroomed, 2 storey traditional residential homes with associated garages and access infrastructure.	Within 100 m	Construction
10(2)	PA/2018/1388	Planning permission to re-develop existing football stadium to deliver 11,000 capacity football stadium (Use Class D2); cafe/bar (Use Class A3/4); commercial space (mixed use); club shop (Use Class A1); site access, car parking and associated infrastructure.	Within 100 m	Construction
11(2)	PA/2018/1389	Outline application for the erection of one hundred and sixty apartments with associated works and some matters reserved.	Within 2 km	Construction
16(4)	PA/2018/2140	Planning permission for the installation of a renewable led energy scheme comprising ground mounted photovoltaic solar arrays and battery-based electricity storage containers together with substations; transformer stations; access; internal access track.	Within 1 km	Construction
17(2)	PA/2018/2186	Outline planning permission for 36 dwellings including new access road and adoptable sewage pumping station (appearance, landscaping, layout and scale reserved for subsequent approval).	Within 1 km	Construction
180	PA/2021/1069	Planning permission to carry out a flood mitigation scheme including the creation of five surface water storage areas and associated works.	Within 2 km	Construction
193	PA/2021/672	Outline planning permission to erect 302 dwellings, to include remediation of the site and means of access as a matter not reserved for subsequent consideration.	Within 1 km	Construction

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ID	Application Reference	Description of Other Development	Location in relation to Order Limits	Overlap in temporal scope
200	PA/2021/1069	Planning permission to carry out a flood mitigation scheme including the creation of five surface water storage areas and associated works.	Within 2 km	Construction
4(1)	PA/2017/1386	Planning permission for highway works to deliver a new terminating junction to the M181 motorway comprising a new at-grade roundabout to access the B1450 Burringham Road from the M181, new B1450 side roads and realignment of the existing B1450, two new.	Within 100 m	Construction
49(1)	PA/2017/1977	Planning permission for the construction of a Flood Defence Scheme comprising of sheet piling along the right bank of the River Trent; the placing of scour protection along the right bank of the River Trent; localised property protection.	Within 2 km	Construction
8(4)	PA/2018/1060	Planning permission to erect a precast concrete manufacturing facility along with external storage areas and associated infrastructure.	Within 1 km	Construction
N1	Section 36 Variation Consent	Keadby 2 Power Station Project. 910 MW Combined gas fired generating station (CCGT).	Within 7.5 km	Operation
N2	Planning Inspectorate Ref: EN010114	Keadby 3 Low Carbon Gas Power Station Project. A combined cycle gas turbine (CCGT) power station, comprising a CCGT unit with a capacity of up to 910 megawatts (MW) electrical output (gross), carbon capture and compression plant, a CO2 export pipeline connection, and associated development.	Within 7.5 km	Operation

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4.6.2 Potential for In-combination Effects

~~4.6.2.1~~ 4.6.2.1 No direct impacts (*eg* landtake) from the Project on European sites have been identified as part of the HRA and therefore the in-combination assessment has focussed on potential indirect impacts identified during the screening stage of the Project.

~~4.6.2.2~~ 4.6.2.2 The air quality assessment concluded that there will be no significant cumulative effects from construction dust. Additionally, surface water interactions for each development will be fully managed under the relevant permitting process and no significant cumulative effects are expected as set out in ES Chapter 18 Cumulative Assessment (**Document Reference 6.2.18**). Consequently the potential for ~~in-combination~~ significant effects as a result of construction dust or surface water interactions were screened out of the in-combination assessment.

~~4.6.2.3~~ 4.6.2.3 Therefore the potential for in-combination effects with other developments was considered for:

- the effect of operational emissions to air; and
- ~~disturbance or displacement of qualifying interest bird species from the Humber Estuary Ramsar site; and~~
- ~~disturbance or displacement of qualifying interest bird species~~ and from the Humber Estuary SPA using functionally linked land.

4.6.3 Potential for In-combination Effects - Operational Emissions to Air

~~4.6.3.1~~ 4.6.3.1 For operational emissions to air, two projects were identified that had the potential for in-combination effects: Keadby 2 Power Station Project and Keadby 3 Low Carbon Gas Power Station Project (see Appendix 3~~Figure 5~~). The potential in-combination effects of these developments are considered in the following sections.

Project Overview: Keadby 2 and Keadby 3

~~4.6.3.2~~ 4.6.3.2 The Keadby 2 Project is a combined cycle gas turbine (CCGT) nearing completion of construction. It received its Environmental Permit to operate in November 2020. Information to support the assessment of in-combination effects is drawn from Keadby Power Station - Environmental Permit Variation Application, Air Quality Impact Assessment and Habitat Regulations Assessment, 29 November 2019 (SSE, 2019)[38].

~~4.6.3.3~~ 4.6.3.3 The Keadby 3 Low Carbon Gas Power Station Project is an NSIP for which the DCO application was accepted in June 2021. In its ES, Keadby 3 assessed air quality effects on protected sites (SSE, 2021a)[39] for the proposed development alone and in-combination with other developments (SSE, 2021b)[40]. In doing so it considered Keadby 2 as part of the baseline and did this by modelling Keadby 2 emissions and adding them to the current baseline. The assessment of Keadby 3 concluded that the Project could potentially have in-combination effects with Keadby 3 but since the Project was at an early stage in the application process insufficient data were available to make an assessment and that the onus would therefore fall on the Project to assess in-combination effects with Keadby 3.

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[38] SSE (2019) Keadby Power Station - Environmental Permit Variation Application, Air Quality Impact Assessment and Habitat Regulations Assessment, 29 November 2019

[39] SSE (2021a) The Keadby 3 Low Carbon Gas Power Station Project, Document Ref: 6.3, Environmental Statement Volume II - Appendix 8B: Air Quality - Operational Phase

[40] SSE (2021b) The Keadby 3 Low Carbon Gas Power Station Project, Document Ref: 5.12, Habitats Regulations Assessment Screening Report

4.6.3.3 Based on a review of the information provided in the Keadby 2 Environmental Permit application (SSE, 2019) and the Keadby 3 ES (SSE, 2021a) the following conclusions on in-combination effects can be made for the pollutants of interest, namely NO_x, ammonia (NH_3), nutrient nitrogen deposition and acid deposition.

~~4.6.3.4~~ 4.6.3.4 It should be noted that the assessments of all three sets of emissions ~~must~~ were originally~~be~~ considered worst case for several reasons, including: (a) the values referred to are generally the highest that occur anywhere within a protected site and will not be coincident for all three projects; (b) predictions are usually from the worst-case year for meteorological data input to the dispersion model; and (c) predictions are based on a worst-case operating hours scenario. In some cases, thise in combination assessment has been updated to include the Project's revised air dispersion modelling based on a ROC and the Keadby 2 4000 operating hours option as stated in HRA report at the permit stage (rather than the original 8760 hours a year operation model). Where the Project's ROC, or Keadby 2 4000 operating hour model has been applied now, this is~~will be~~ clearly stated ~~in the text~~.

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Emissions of NO_x (annual average and 24 hours)

4.6.3.5 For annual average NO_x, the Keadby 2 and 3 assessments predict contributions at the Humber Estuary SAC / ~~and~~ Ramsar site of 12.39% (4,000 hrs instead of 2.9% with 8760 hrs) and 1.6% of the critical level respectively. The Project ~~also~~ makes a contribution of 3.03~~6.8~~% (ROC) of the critical level at these sites. For the Humber Estuary SPA, the Keadby 2 and 3 assessments predict contributions of 0.6% (8760, but will be less for 4000 hrs) ~~.~~ and 0.4% respectively, and the Project makes a contribution of 0.89~~1.0~~% (ROC) of the critical level. It should be noted that these contributions will not coincide at the same locations within these European sites. More importantly, there is substantial headroom before the in-combination predicted environmental concentration (i.e. baseline, plus Keadby 2, Keadby 3 and the Project) meets and / or exceeds 70% of the critical level (i.e. the threshold guideline used to indicate a need for further assessment, if it is exceeded).

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~~4.6.3.5~~ 4.6.3.6 ~~–~~Contributions of annual NO_x were substantially lower than 1% of the critical level at Thorne Moor SAC / Thorne & Hatfield Moors SPA based on the previous version of the HRA report (with contributions of 0.1%, 0.2% and 0.2% of the critical level predicted for the Project, Keadby 2 and Keadby 3[41] respectively).

4.6.3.7 ~~It should be noted that these contributions will not coincide at the same locations within these European sites. More importantly, there is substantial headroom before the in-combination predicted environmental concentration (i.e. baseline, plus Keadby 2, Keadby 3 and the Project) meets and / or exceeds 70% the critical level (i.e. the threshold guideline used to indicate a need for further assessment, if it is exceeded).~~ Therefore no in-combination effects are predicted from Annual Average NO_x concentrations.

~~4.6.3.6~~ 4.6.3.8 ~~. Regarding s~~Short-term NO_x concentrations ~~these~~ cannot, for reasons of meteorological conditions, simultaneously affect the same protected site (or part thereof) and so are not considered further.

Ammonia

4.6.3.9 Based on the 4000 hours operating case Keadby 2 ~~and 3~~ assessment~~s~~ predicts a PC ~~process contributions~~ of ammonia of ~~3.2% (8760 hours a year operation) reduced to~~ 1.5% ~~(based on the~~ 4000 hours~~) model~~ of ~~and 0.5% respectively of~~ the critical level at Humber Estuary SAC / ~~and~~ Ramsar site, compared with 3.2% for the 8760 hours case. Keadby 3 predicts a PC~~process contributions~~ of ~~ammonia of~~ 0.5% and t~~.~~ ~~T~~he Project

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[41] The NO_x contribution for Keadby 3 refers to Thorne Moor SAC only as contributions for Thorne & Hatfield Moors SPA were not presented.

is predicted to make a process contribution of 0.651.6% (ROC) instead of 1.6% (previous modelling)of the critical level at Humber Estuary SAC and Ramsar site. Overall the updated in-combination PC contribution is 2.65% (1.5 + 0.5 + 0.65) of the critical level.

~~4.6.3.7~~ 4.6.3.10 For the Humber Estuary SPA, the Keadby 2 and 3 assessments predict PCcontributions of 0.36% (4000 hrs) instead of 0.63% (8760 hrs)based on the 4000 hour model) and 0.1% of the critical level respectively, and the Project makes a PC process contribution of 0.728% (ROC) instead of 0.7% (previous modelling)of the critical level. Overall the updated in-combination PC contribution is 0.68% (0.3 + 0.1 +0.28) of the critical level.

4.6.3.11 At Thorne Moor SAC, ammonia PCscontributions from the Project, Keadby 2 and Keadby 3 are predicted as 0.082% (ROC) instead of 0.2% (previous modelling), 0.3% (4000 hrs) instead of 0.7% (8760 hrs) 0.7% (0.3% based on the 4000 hour model) and 0.2% of the critical level respectively. Overall the updated in-combination PC contribution is 0.58% (0.08 + 0.3 +0.2) of the critical level.

~~4.6.3.8~~ 4.6.3.12 Thorne & Hatfield Moors SPA has similar Project PCcontributions at 0.103% (ROC) instead of 0.07% (previous modelling) and 0.3% (4000 hrs) instead of 0.6% (8760 hrs) of the critical level for the Project and 0.6% (0.3% based on the 4000 hour model) of the critical level for Keadby 2. The (no data for Keadby 3 report provided no relevant data on ammonia, although based on comparisons at other sites it is likely that levels at Keadby 3 would be much lower than from Keadby 2). Overall the updated in-combination PC contribution is 0.33% for the Project and Keadby 2 (0.03 + 0.3) of the critical level and it is unlikely that any contribution from Keadby 3 would cause the combined PCs to exceed 1%.

~~4.6.3.9~~ 4.6.3.13 In-combination with those from Keadby 2 and 3, there is a need for further assessment of the effects of ammonia on the Humber Estuary SAC/Ramsar only and this is considered further in the Appropriate Assessment, SPA and Ramsar site, Thorne Moor SAC and Thorne & Hatfield Moors SPA.

Nitrogen Deposition

4.6.3.14 At the Humber Estuary SAC / Ramsar site, tThe Keadby 2 assessment predicts a PCcontribution of nutrient nitrogen of 1.3%2.0 (minimum) to 0.872.9% (maximum) (4000 hours model) of the critical load at Humber Estuary SAC and Ramsar site,with and Keadby 3 assessment predicts a contribution of 0.7% and t. The Project is predicted to make a contribution of 0.962.3% (min) to 0.64% (max) (ROC) of the critical load at Humber Estuary SAC and Ramsar site. Overall the updated in-combination PC contribution is 2.96% (min) – 2.21% (max) (0.96 + 1.3 + 0.7 (min) / 0.64 + 0.87 + 0.7 (max)) of the critical load.

4.6.3.15 For the Humber Estuary SPA, Keadby 2 predicts PC contributions of 0.35% to 0.17% (4000 hours model) 0.4 – 0.8% of the critical load, Keadby 3 predicts a contribution of 0.2%, and the Project predicts contributions of 0.735 – 0.470.9% (minimum depending on interest feature) to 0.24% (maximum) of the critical load. Overall the updated in-combination PC contribution is 0.9 – 1.02% (min) – 0.61% (max) (0.35 + 0.2 + 0.35 / 0.35 + 0.2 +0.47 (min) / 0.17 + 0.2 + 0.24 (max)) of the critical load.

~~4.6.3.10~~ 4.6.3.16

At Thorne Moor SAC, PCs as a percentage of the critical load nitrogen deposition from the Project, Keadby 2 and Keadby 3 are predicted as 0.13% (min) - 0.073% (max) (Project ROC and maximum critical load), 0.37% (min) - 0.188% (max) (Keadby 2 4000 hours model and maximum critical load), and 0.2% (Keadby 3)of the critical load respectively. Overall the updated in-combination PC contribution is 0.7% (min) – 0.45% (max)

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~~4.6.3.11~~ 4.6.3.17 PC contributions a~~A~~t Thorne & Hatfield Moors SPA as a percentage of the critical load ~~, contributions are~~ are 0.07~~3~~% (min) – 0.03% (max)~~of the critical load for the~~ (Project ~~(~~ROC) and 0.4~~18~~% (min) – 0.09% (max) (Keadby 2 4000 h~~ours model~~). No data were available for ~~of the critical load for Keadby 2 (no data for~~ Keadby 3~~)~~. Overall the updated in-combination PC contribution is 0.25% (min) – 0.12% (max) of the critidcal level for the Project and Keadby 2 and it is unlikely that any contribution from Keadby 3 would cause the combined PCs to exceed 1%.

~~4.6.3.12~~ 4.6.3.18 In-combination with ~~those of~~ Keadby 2 and 3, there is a need for further assessment of the effects of nitrogen deposition on the Humber Estuary SAC/Ramsar only and this is considered further in the Appropriate Assessment.~~, SPA and Ramsar site, Thorne Moor SAC and Thorne & Hatfield Moors SPA~~.

Acid Deposition

~~4.6.3.13~~ 4.6.3.19 ~~Individually the Project, Keadby 2 and Keadby 3 predict that the effects on acid deposition were insignificant at~~ Thorne Moor SAC is ~~(~~the only European site which is sensitive to the effects of acid deposition ~~in this assessment)~~. PCs as a percentage of the critical load ~~Acid deposition~~ from the Project (ROC), Keadby 2 (4000 hrs) and Keadby 3 are predicted as 0.23% ~~(ROC)~~, 0.28% ~~(4000 hours model),~~ and 0.2% ~~of the critical load~~ respectively. ~~Keadby 3 predicted no appreciable contribution of acid deposition on Thorne Moor SAC (0.0% of the critical load). However, i~~In-combination the combined emissions from the Project, ~~and~~ Keadby 2 and Keadby 3 are predi~~c~~cted to be 0.71%, and are screened out as they are ~~not expected to may equal or exceed~~ well below ~~the~~ 1% of the critical load threshold~~, with contributions of 0.4% and 0.6% of the critical load respectively. Further consideration has been given to acid deposition based on the above and the already high background levels of acid deposition at Thorne Moor SAC.~~

Summary~~Conclusion~~

4.6.3.20 ~~As there is potential for the operational phases of these projects to coincide~~ The findings of the revised modelling assessment show that ~~with that of the Project,~~ the potential for likely significant effects on the Humber Estuary SAC / Ramsar site ~~European sites~~ could not be excluded and further assessment was required as part of the AA (see Section 5.5). Effects from other pollutants on other European sites in-combination have been screened out.

4.6.4 *Potential for In-combination Effects - Disturbance or Displacement of Qualifying Interest Bird Species*

~~4.6.4.1~~ 4.6.4.1 The location of other projects in the vicinity of the Project was considered in relation to potential in-combination effects of disturbance or displacement of birds from the Humber Estuary Ramsar site and / or functionally linked land of the Humber Estuary SPA (through disturbance to mallard on the River Trent and ~~its immediately~~ adjacent banks /fields~~, which is considered functionally linked land for mallard protected under the SPA designation~~).

~~4.6.4.2~~ 4.6.4.2 Fifteen developments were identified within 2 km of the Project, which are mostly associated with the existing industrial estate and nearby residential areas (see Appendix 3~~Figure 6~~). ~~While there will be some localised disturbance to local bird populations, a~~All but one of the developments (see below) are over 1 km from the River Trent and the ~~Humber Estuary~~ Ramsar site.~~designation and the potential for in-combination disturbance effects is low. No likely significant in-combination disturbance effects on the Humber Estuary Ramsar bird populations are expected.~~

4.6.4.3 As illustrated in the figures in Appendix 3~~on Figure 6~~, no new developments with the potential for disturbance effects on birds were identified within the extended 2 km

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zone up the River Trent. Only one development was identified close to the River Trent, which was a flood defence scheme which could cause disturbance during construction. However, this development is situated over 4 km south of the stretch of the River Trent which will be affected by disturbance from the Project, and also almost 1 km from ~~outside of~~ the Ramsar boundary. ~~At this distance, in-combination effects are considered unlikely.~~

4.6.4.4 None of the developments are likely to~~ot~~ affect areas of functionally linked land supporting birds from the SPA.

~~4.6.4.3~~ 4.6.4.5 Given the distances of the other developments, ~~N~~no likely significant in-combination ~~disturbance~~ effects on bird species of the Humber Estuary Ramsar, or functionally linked land of the SPA ~~bird populations~~ are expected.

5. APPROPRIATE ASSESSMENT

5.1 Introduction

5.1.1.1 The HRA screening identified that further consideration was required as part of an Appropriate Assessment (AA) on the followingwas required for the effects of:

- the effects on surface water quality on the Humber Estuary SAC / Ramsar site;
- the effects of construction dust on the Humber Estuary SAC / Ramsar site;
- ~~5.1.1.1~~ potential disturbance from noise to mallard on the River Trent Ramsar site and on ~~using~~ functionally linked land associated with the Humber Estuary SPA; and~~.~~
- ~~NO_x (24 hour), ammonia and deposited nitrogen on the Humber Estuary SAC / Ramsar site;~~
- ~~surface water quality on the Humber Estuary SAC / Ramsar site;~~
- the effects of ammonia and nitrogen deposition on the Humber Estuary SAC / Ramsar site in-combination with Keadby 2 and 3.~~construction dust on the Humber Estuary SAC / Ramsar site; and~~
- ~~potential disturbance to mallard using functionally linked land associated with the Humber Estuary SPA.~~

~~5.1.1.2~~ 5.1.1.2 This section assesses the impacts of the Project on the relevant qualifying interest features of each site including any mitigation measures that have been drawn up. Contour plots have been produced to assist with the assessment of the potential effects of emissions to air, which illustrate the dispersion extent and concentrations of the pollutants as a percentage of the PC. The aim of the AA was to identify whether no adverse effect on the integrity of the European sites can be concluded, or whether adverse effects on the integrity of the European sites will result.

~~5.1.2 Drone Survey~~

~~5.1.2.1 As saltmarsh habitat was a key consideration in the AA, a drone survey was undertaken in June 2020 to remotely map the habitats along the length of the River Trent up and downstream from the Project site. Ground truthing of the data has not yet been undertaken so the results should be viewed as indicative rather than definite.~~

~~5.1.2.2 Figure 7 provides a comparison of the drone survey results and the Natural England Priority Habitat Inventory Dataset from Defra's MAGIC map website. The drone survey results indicated that the majority of the habitat lining the River Trent was reedbed with intermingled small areas of upper saltmarsh (represented as 'reedbed' on the map). While the NE dataset categorises it as saltmarsh, NEs supplementary advice on the Humber Estuary SAC saltmarsh habitat also suggests that reedbed is widespread. The advice notes that the tidal marsh community is dominated by Phragmites australis (common reed) and Bulboschoenus maritimus swamp (sea club-rush), along with Elymus repens (couch grass) saltmarsh community. These reedbed-dominated habitats account for more than 50% of the total tidal vegetation in the inner estuary down to the King George V Bridge at Gunness (which lies south of the Project site). The Environment Agency (EA) dataset on saltmarsh extent & zonation also shows that~~

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~~*reedbed is the dominant habitat type along the River Trent, with small areas of fringing upper saltmarsh[42].*~~

~~*5.1.2.3 Therefore, it is concluded that reedbed is more common along the River Trent than the MAGIC dataset shows and it will be assumed for the assessment that a mosaic of reedbed and upper saltmarsh habitat exists in these areas. The EA dataset of saltmarsh extent was used for the contour maps as the most up to date official information source.*~~

5.2 Humber Estuary SAC / Ramsar

~~*5.2.1 Effects of NOx*~~

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~~*5.2.1.1 The PC for daily (24 hour) NO_x at the Humber Estuary SAC / Ramsar site exceeded the 10% threshold at 48.7% of the critical level. Daily (24 hour) NO_x is a measure of short term peaks in emissions over the course of a day. These short term emissions are less likely to have a significant impact on vegetation.*~~

~~*5.2.1.2 The Institute of Air Quality Management (IAQM) guide to the assessment of air quality impacts on designated nature conservation sites[43] notes that long term (annual mean) concentration of NO_x is the most relevant for its impacts on vegetation as the effects are additive in nature over months and years. The effects of long term NO_x was assessed as insignificant for the Humber Estuary SAC / Ramsar site in the HRA screening.*~~

~~*5.2.1.3 A contour plot (Figure 8) was produced to illustrate the main areas where 24hr NO_x was predicted to exceed the 10% threshold of the critical level. The contour plot shows that 9.4 ha of reedbed and 2.8 ha of upper saltmarsh habitat is affected along the Humber Estuary SAC / Ramsar site, extending up and downstream of the stack locations. Emission levels are only slightly over the 10% threshold over approximately half of this area, with a peak rising up to 48.7% of the critical level on the section of the River Trent adjacent to Flixborough Industrial Estate (where reedbed is dominant). Qualifying interest habitats in this area are limited to the small scattered areas of upper saltmarsh. The dominant habitat present is reedbed which is not a qualifying interest feature for either designated site.*~~

~~*5.2.1.4 The exceedance of the 10% threshold of the critical level will be of a short term nature which is less damaging to habitats, and will occur in an area with very little qualifying interest habitat. 9.4 ha of reedbed (which equates to 1% of reedbed extent within the SAC / Ramsar) and 2.8 ha of upper saltmarsh (0.3% of saltmarsh extent within the designated site) are within the exceedance zone but a much smaller part of this area (adjacent to Flixborough Industrial Estate) will actually experience the peak levels of emissions. Background levels of NO_x are low (well below the critical level for NO_x) which suggests that the saltmarsh could accommodate small increases in NO_x without adverse effects. Given the very small area of effect, its short*~~

~~[42] Environment Agency Dataset: Saltmarsh Extent & Zonation.~~

~~[43] Holman et al (2019). A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.0, Institute of Air Quality Management, London.~~

~~*term nature and the lack of qualifying interest habitats in this location, the effect of 24hr NO_x is not expected to be significant or negatively affect the conservation objectives of the Humber Estuary SAC/Ramsar. It is concluded that there will be no adverse effect on site integrity.*~~

~~*5.2.2 Effects of Ammonia*~~

~~*5.2.2.1 The PC for ammonia at the Humber Estuary SAC / Ramsar site marginally exceeded the 1% threshold at 1.6% of the critical level. The PEC was also exceeded (120.9% of the critical level) due to high background levels of ammonia (predominantly due to agricultural sources) in the local area.*~~

~~*5.2.2.2 A contour plot (Figure 9) was produced to illustrate the main locations where ammonia was predicted to exceed the 1% threshold. This plot shows that the areas of the Humber Estuary SAC / Ramsar site affected by an exceedance of the 1% threshold are extremely limited. One small section of the River Trent lies within the 1% critical level contour line south of Flixborough Industrial Estate, where the PCs are predicted to reach between 1 and 1.6% of the critical level (i.e. only marginally over the 1% exceedance threshold). This area is dominated by reedbed habitat. There is one further area north of the industrial estate where the 1% contour line just skims the edge of the River Trent.*~~

~~*5.2.2.3 As detailed above, qualifying interest habitats in this area are limited, with reedbed dominating the riverside vegetation. It is possible that there are small areas of saltmarsh (a qualifying interest habitat) alongside this stretch of the River Trent but these would be small, marginal areas of habitat. The EA dataset suggests that 3.7 ha of reedbed vegetation (0.4% of the total extent of reedbed across the SAC / Ramsar) and 0.3 ha of upper saltmarsh (0.03% of the total extent of saltmarsh) will be affected.*~~

~~*5.2.2.4 Given the very small areas of the River Trent affected, and the marginal exceedance of the 1% threshold, it is considered unlikely that the exceedance of ammonia will result in any significant effects. The conservation objectives of the Humber Estuary SAC will not be affected and no adverse effect on site integrity is expected.*~~

~~*5.2.3 Effects of Deposited Nitrogen*~~

~~*5.2.3.1 The effects of deposited nitrogen were assessed further for the Humber Estuary SAC / Ramsar site, in relation to Atlantic saltmeadow (saltmarsh) and estuary habitats.*~~

~~*5.2.3.2 The PC for deposited nitrogen at the Humber Estuary SAC / Ramsar site exceeded the 1% threshold (2.3% of the critical load) and the PEC exceeded the 70% threshold (146.8% of the critical load) for Atlantic saltmeadow (saltmarsh) and estuary habitat types, hence the site was taken forwards for further consideration. For the estuary habitat type, the underlying sensitive habitat assessed was also saltmarsh. Background levels of nutrient nitrogen*~~

~~*are high, predominantly due to agricultural practices which led to the exceedance of PEC.*~~

~~*5.2.3.3 The contour plot for the Humber Estuary SAC / Ramsar site (Figure 10) shows that the areas of the designated site affected by an exceedance of the 1% threshold are extremely localised, mainly affecting short lengths of the River Trent directly adjacent to the Project (which are almost exactly the same locations as those affected in the ammonia contour plot). In total, 4.4 ha of reedbed and 1.2 ha of upper saltmarsh vegetation is located within the 1% critical load contour line, which equates to 0.4% and 0.1% of the total areas of these habitats across the SAC / Ramsar respectively.*~~

~~*5.2.3.4 Therefore, Figure 10 illustrates that a combination of reedbed and upper saltmarsh will be affected. Even if all of the habitat was saltmarsh (a qualifying feature of the Humber Estuary SAC / Ramsar), the very small areas of the River Trent affected, the localised areas of effect (the peak of 2.3% of the critical load is restricted to one location immediately adjacent to Flixborough Industrial Estate) and the fact that the majority of the area is affected by contours only marginally over the 1% exceedance threshold means that it is considered unlikely that there will be any significant effects on the saltmarsh habitat. The conservation objectives of the Humber Estuary SAC / Ramsar will not be affected and no adverse effect on site integrity is expected.*~~

~~*5.2.4*~~5.2.1 *Surface Water Quality*

~~*5.2.4.1*~~ 5.2.1.1 The HRA screening identified that, in the absence of mitigation, there was potential for the Humber Estuary SAC / Ramsar site to be adversely affected by contaminated surface water runoff into the River Trent.

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~~*5.2.4.2*~~ 5.2.1.2 The River Trent is downstream of the Project and surface water interactions from the Project (e.g. through local drains and ditches) will ultimately run in to the river. However, industry best practice techniques will be followed for all surface water crossings and interactions (such as the crossing of drains and agricultural ditches within the Order Limits) which is expected to result in negligible impacts on local water resources (as detailed in Chapter 9 Water Resources and Flood Risk, **Document Reference 6.2.9**). Therefore, it is reasonably expected that any effects further downstream at the River Trent would also be negligible. Therefore no likely significant effect on water quality is expected. No adverse effect on the site integrity of the Humber Estuary SAC / Ramsar site is expected.

~~*5.2.5*~~5.2.2 *Construction Dust*

5.2.2.1 In the absence of mitigation, the HRA screening identified the potential for construction dust impacts on the qualifying interest habitats or species of the Humber Estuary SAC / Ramsar site.

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5.2.2.2 The final Construction and ~~Envrionmental~~Environmental Management Plan (CEMP) will contain best practice measures that will be implemented by the site contractors to control dust, so that there is negligible effect beyond the Red Line Boundary.

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~~*5.2.5.1*~~ 5.2.2.3 These measures will prevent any adverse effects on the ecological features (*e.g.* the designated areas along the River Trent) within 200m of the Red Line Boundary and hence comply with Natural England's guidance.

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~~5.2.5.2 With embedded, standard best practice measures in place, the impacts of construction dust were predicted to be of negligible or at worst, minor significance in the air quality assessment (see Chapter 5 Air Quality, **Document Reference 6.2.5**). The nearby habitats of the Humber Estuary SAC / Ramsar that could be affected by dust are reedbeds and small areas of saltmarsh lining the River Trent. The existing port (Flixborough Wharf) lies between the river and construction work to the north but there are some areas to the south where work will be very close to the River Trent (e.g. the railway reinstatement). Any increased dust at these locations would be a localised and small scale impact on these habitats which is not predicted to be significant. Therefore, no adverse effect on the site integrity of the Humber Estuary SAC / Ramsar site is expected.~~

5.3 Humber Estuary Ramsar Site and Functionally Linked Land of the Humber Estuary SPA – Disturbance Effects on Birds from Noise

~~5.3~~ 5.3.1.1

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~~5.3.1 Disturbance to Functionally Linked Land~~

~~5.3.1.1 The effects of potential disturbance to wintering mallard using the River Trent were also assessed further, as surveys established that the river and its immediately adjacent banks could be classed as functionally linked land used by mallards outside of the Humber Estuary SPA boundary.~~

~~5.3.1.2 Increased vessel movement has the potential to cause disturbance to mallard using the River Trent and its immediately adjacent banks. Freight transport by river during construction (2023 – 2028) would mainly comprise bringing imported fill to the site and is expected to result in between 4 and 16 additional vessel movements at Flixborough Wharf per month, with a maximum total of 80 vessel movements per year between 2023 and 2028 (see Chapter 13 Traffic and Transport, **Document Reference 6.2.13**). Therefore, there would be an estimated 4 extra vessels per week at peak in addition to the approximate one vessel per day currently. Freight transport by river during the operational phase is estimated to result in 580 additional vessel movements at Flixborough Wharf per year. Compared to the 305 vessel movements in 2019, this is an increase of almost 200% and nearly 50 additional vessel movements per month. This increased movement would result in approximately 2 – 4 vessel movements per day (based on 360 or 240 days per annum scenarios), in comparison to approximately one vessel per day previously.~~

~~Mallard using the River Trent and its immediately adjacent banks will be habituated already to the movement of vessels on the water currently and it is not expected that a small increase in boat movements per day would create a significant disturbance effect. The increase in vessel movements is very small in the construction phase (a 6 year period), which will allow habituation to small increases in vessel movements before the operational phase of the Project. Mallard are also a species that are often tolerant of humans and not particularly sensitive to disturbance[44].~~

~~The construction and operation of the Project will result also in increased noise, which could lead to disturbance or displacement of birds. As discussed in section XX,~~ tThe main effects are likely to be on small numbers of mallard along the River Trent to the west / south-west of the Project area. As discussed above, ~~Whilst~~ unmitigated, levels ~~much~~ higher than 55 dB $L_{Aeq,12\ hr}$ are likely to result in these areas, especially due to activities such as breaking of concrete, that are predicted to generate unmitigated levels of 75 dB L_{Aeq} (72 dB L_{Aeq} without

~~[44] Woodward, I. D., Calbrade, N. A. and Holt, C.A. (2015) Humber Estuary Bird Decline Investigation 2014. BTO Research Report No. 668.~~

façade effect) at 100 m. Distances around the works before the 55 dB $L_{Aeq,12\ hr}$ threshold is reached is likely to be in the order of 275 – 360 m for building works, approaching 500 m for concrete breaking and approximately 160 m for works on the railway.

5.3.1.2 ~~,~~However, taking account of mitigation (*e.g.* through the use of noise barriers around the construction works) the distances around the works before the 55 dB $L_{Aeq,12\ hr}$ threshold is reached, are expected to decrease. For example, they are expected to drop to around 160 m for building works and approximately 225 m for conreate breaking[45]. The figure in Appendix 3 ~~it is expected that mitigation will bring actual levels closer to 55 dB $L_{Aeq,12\ hr}$; Most of the bird records in this area were from the riverbanks on the western side, or on the water. If a reduction of 10 dB is achieved, it is predicted that the western riverbanks and the western parts of the river would experience noise levels of <55 dB $L_{Aeq,12\ hr}$; ~~

~~Figure 0.3~~ shows two predicted noise level contours for each of the building construction areas and the concrete breaking, ~~and~~ including noise levels associated with bored piling. The contours show a range between no mitigation (blue) and a reduction of 10 dB (orange), which is the upper end of what the noise mitigation is likely to ~~be~~ achiev~~able~~. ~~-~~ Actual distances ~~mitigation~~ will be confirmed as part of the mitigation coinfirmation by the contractors prior to construction and it is likely to be somewhere in between these un-mitigated and mitigated contours.

5.3.1.3 Most of the records of mallard in this area were from the riverbanks on the western side, or on the water (see Appendix 3). If a reduction of 10 dB is achieved, it is predicted that the western riverbanks and the western parts of the river would experience noise levels of <55 dB $L_{Aeq,12\ hr}$ and hence birds in these locations would not be significantly affected. ~~.~~Mallard is ~~are also~~ a species also that is~~are~~ often tolerant of humans and not particularly sensitive to disturbance[46].~~Predicted un-mitigated levels during building construction across the river from the site at Amcotts approximately 320 m west of the Project (Location 3 – see Chapter 7) are up to 62 dB L_{Aeq} (at 1 m from the façade of the building), but along the river west of Location 1, approximately 900 m from the Project Red Line Boundary, levels are predicted to have reduced to approximately 50 dB $L_{Aeq,}$ a level that are unlikely to result in significant effects on birds. In open areas away from buildings the noise level would be 3 dB lower. Mitigation (eg hoarding) is likely to reduce these levels by about 10 dB L_{Aeq} and hence in practice the effects of noise on birds associated with the designated sites (predominantly mallard, with occasional redshank) along the river (upstream and downstream) are expected to be much more localised along the river.~~

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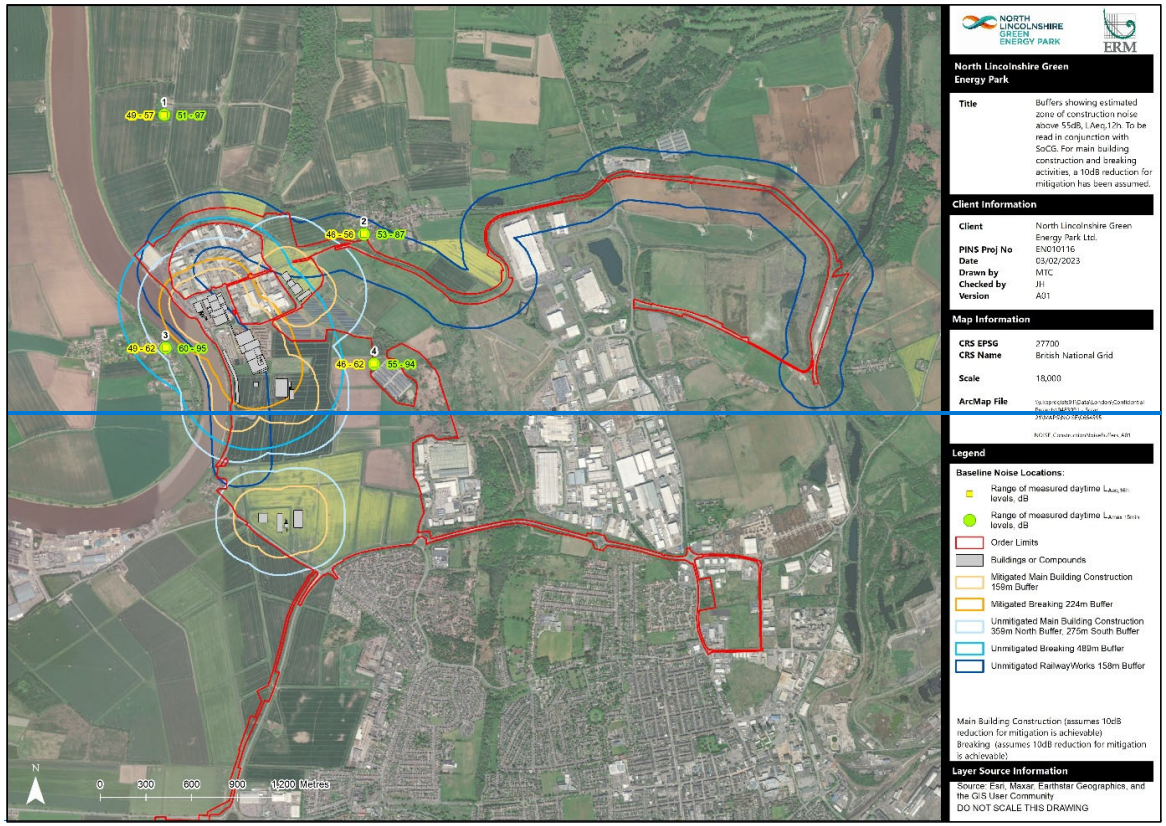
[45] In terms of mitigation, it has been assumed that there is hard ground throughout as, should noise barriers be used, this would raise the effective source height and lessen the attenuation effect of the soft ground.
[46] Woodward, I. D., Calbrade, N. A. and Holt, C.A. (2015) Humber Estuary Bird Decline Investigation 2014. BTO Research Report No. 668.



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In addition, ~~Predicted un-mitigated levels during building construction across the river from the site at Amcotts approximately 320 m west of the Project (Location 3 – see Chapter 7) are up to 62 dB L_{Aeq} (at 1 m from the façade of the building), but along the river west of Location 1, approximately 900 m from the Project Red Line Boundary, levels are predicted to have reduced to approximately 50 dB $L_{Aeq,}$ a level that are unlikely to result in significant effects on birds. In open areas away from buildings the noise level would be 3 dB lower. Mitigation (eg hoarding) is likely to reduce these levels by about 10 dB L_{Aeq} and hence in practice the effects of noise on birds associated with the designated sites (predominantly mallard, with occasional redshank) along the river (upstream and downstream) are expected to be much more localised along the river.~~

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~~Some more elevated noise levels are likely, associated with specific activities for example, breaking of concrete that are predicted to generate unmitigated levels of 75 dB L_{Aeq} (72 dB L_{Aeq} without façade effect) at 100 m. However, hoardings will be installed to help reduce the noise levels at local properties and it is expected that these alone will reduce the levels generated by such activities by approximately 10 dB and that free-field noise levels could be down to or below 55 dB L_{Aeq} at 400 – 500 m.~~

~~Wherever possible~~ the measures listed below will be implemented to further reduce the risk of significant effects on mallard associated with designated sites.

- T~~t~~he timing of construction activities likely to generate higher noise levels will be undertaken outside the period October to March wherever possible~~to avoid effects on bird species associated with the designated areas (e.g. between October and March).~~
- Implementation of the Construction Ornithology Monitoring Plan (COMP), an outline of which is included as part of the Code of Construction Practice (CoCP). The COMP will be taken to a detailed form as part of the Construction Environmental Management Plan (CEMP) that will be prepared by the contractor prior to works commencing and agreed with Natural England. This will be implemented by a requirement of the DCO. The COMP will contain a series of measures to monitor for signs of any disturbance to qualifying interest bird species of the designated sites during construction. Specific construction activities that require it to be implemented will be agreed with Natural England as part of its detailed development. The COMP will be overseen by an Ecological Clerk of Works (ECoW) and should any significant disturbance events be recorded, the COMP will outline additional measures that the ECoW will be able to implement to prevent significant effects to qualifying interest bird species and avoid adverse effects on the integrity of the designated sites (eg the COMP could be activated prior to any piling activities and measures could include a 'soft start' approach for piling activities which would allow any early signs of effects to be identified before they became of concern and before any significant effects to birds occur). The remit of the ECoW would allow work to be stopped, paused, retimed, or for an alternative method of working to be taken.

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~~Implementation of the~~ In addition, ~~there is an outline~~ ~~Construction Ornithology Monitoring Plan (COMP), an outline of which is included as part of the Code of Construction Practice (CoCP). The COMP is will be taken to a detailed form as part of the Construction Environmental Management Plan (CEMP) that will be prepared by the contractor prior to works commencing and agreed with Natural England. This will be implemented by a requirement condition of the DCO. The COMP will contain a series of measures to monitor for signs of any disturbance to qualifying interest bird species of the designated sites during construction. Specific construction activities that require it to be implemented~~

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will be agreed with Natural England as part of its detailed development. The COMPOMCP will be overseen by an Ecological Clerk of Works (ECoW) and should any significant disturbance events be recorded, the COMP will outline additional measures that the ECoW will be able to implement to prevent significant effects to qualifying interest bird species and avoid adverse effects on the integrity of the designated sites (eg the COMP could be activated prior to any piling activities and, measures could include a 'soft start' approach for piling activities which would allow any early likelihoodsigns of effects to be identified before theyit became of concern and before any significant effects to birds occurdisturbed). The remit of the ECoW would allow Such measures work to be stopped, paused, retimed, or for an alternative method of working to be takencould include stopping work, pausing of work, retiming of work, or alterations to the methods of working.

5.3.1.5 Once operational, noise levels are predicted to be much lower as expected, with only areas adjacent to the works exceeding 55 dB LAeq

5.3.1.6

The predicted distances for mitigated construction noise to reduce to 55 dB, $L_{Aeq,12\ hr}$ are listed below.

Main Building Construction

Mitigated - both 159 m.

Concrete Breaking

Mitigated – 224 m.

5.3.1.4 If the mitigation achieves a reduction of close to 10 dB, then predicted noise levels above 55 dB LAeq,12 hr decrease significantly to approximately 225 m. As noted above, the actual distances are likely to be somewhere in this range and depend on the reduction in dB the mitigation achieves. Once operational, noise levels are predicted to be much lower as expected, with only areas adjacent to the works exceeding 55 dB LAeq (see Chapter 7). Given the above, adverse effects on the integrity of the designated sites due to the effects of from construction noise on birds are not expected.

5.3.1.5 The construction and operation of the Project will result also in increased noise, artificial lighting, traffic and human disturbance which could lead to disturbance or displacement of birds. However, the mallard populations are highly mobile and there are extensive areas of similar habitat in the local area which any displaced birds could move in to. The raised earth embankments around the River Trent also provide some screening of activity to birds on the river and its immediately adjacent banks. The existing industrial location of the site means that birds will be habituated to some disturbance already, and surveys have confirmed that only low numbers of birds are present. Therefore the effect of disturbance such as noise, lighting or traffic on mallard associated with the Humber Estuary SPA would be low. The majority of the SPA mallard population will be situated far from the Project around the main Humber Estuary and any short term and small scale effects along a short section of the River Trent are expected to be negligible. Therefore no adverse effect on the site integrity of the Humber Estuary SPA is expected.

5.4 Summary of Appropriate Assessment – Project Alone

5.4.1.1 5.4.1.1 The background levels of ammonia and nutrient nitrogen around the Humber Estuary are already high (exceeding the critical level or load), largely as a result of agricultural

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practices. This means that there is little capacity for increased PC levels in the air quality modelling which has flagged up potential exceedances for in-combintion effects.

5.4.1.2 However, by looking closer at habitat locations and contour plots illustrating where the qualifying interest features and main areas of effect are likely to be, it was possible to rule out any potential significant effects as a result of the Project. The AA concluded that there will be no adverse effects on site integrity at the Humber Estuary SAC / Ramsar site in terms of NO_x (24 hour), ammonia and deposited nitrogen (for saltmarsh habitats).

5.4.1.3 It is also worth giving consideration to recent and on-going trends in the baseline emissions and concentrations of the pollutants of concern. This is discussed in Section 5.5 in the context of in-combination effects.

5.4.1.4 Based on the assessment above, no adverse effects on European sites are predicted due to the effects on water quality, dust or noise. The potential effects of disturbance on mallard using functionally linked land associated with the Humber Estuary SPA were also considered. It was concluded that any short term and small scale disturbance to the mallard present along a short section of the River Trent and its immediately adjacent banks would have no adverse effects on the site integrity of the Humber Estuary SPA.

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5.5 In-combination Effects – Appropriate Assessment

5.5.1.1 5.5.1.1 The HRA screening assessment identified the need for further consideration of found that further assessment was required to assess the potential likely effects of ammonia and deposited nitrogen on the Humber Estuary SAC / Ramsar site operational emissions to air from the Project in-combination with operational emissions from the Keadby 2 Power Station Project and the Keadby 3 Low Carbon Gas Power Station Project. This section assesses the potential for in-combination effects on designated sites as a result of these combined emissions. Whilst in-combination the PCs exceeded

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Exceedences due to in combination effects were identified at the Humber Estuary SAC. Exceedances greater than 1% of the cCritical levels / lLoads, are predicted in-combination from ammonia and nitrogen deposition. In both cases the contribution from the Project in both cases wasis <1% of the Critical Load. The actual loads of deposited nitrogen from Keadby 2 that overlap with the Project will, however, be much lower than the figures shown in Section 5.2.

5.5.1.2 As the main area of affect was along the River Trent, further analysis was undertaken of the habitats likely to be affected. NE's supplementary advice on the Humber Estuary SAC saltmarsh habitat suggested that reedbed was widespread and that the tidal marsh community is dominated by *Phragmites australis* (common reed) and *Bulboschoenus maritimus* swamp (sea club-rush), along with *Elymus repens* (couch grass) saltmarsh community. These reedbed-dominated habitats were thought to account for more than 50% of the total tidal vegetation in the inner estuary down to the King George V Bridge at Gunness (which lies south of the Project site). The Environment Agency (EA) dataset on saltmarsh extent & zonation also indicated that reedbed habitat was the dominant habitat type along the River Trent, with small areas only of fringing upper saltmarsh[47]. The reedbed habitat is part of the Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) qualifying interest feature of the Humber Estuary SAC, but there is no indication of the narrow reedbeds along the River Trent being of interest also as supporting habitat for species such as qualifying interest bird species of European sites.

5.5.1.3 A drone survey was undertaken in June 2020 to remotely[48] map the habitats along the length of the River Trent up and downstream from the Project site. A comparison

[47] Environment Agency Dataset: Saltmarsh Extent & Zonation.
[48] No ground truthing of the drone footage has been undertaken.

of the drone survey results and the Natural England Priority Habitat Inventory Dataset from Defra's MAGIC map website are provided in Appendix 3. The drone survey results indicated that the majority of the habitat lining the River Trent was reedbed habitat with intermingled small areas of upper saltmarsh. The EA dataset of saltmarsh extent was used for the air dispersion contour maps as the most up to date official information source ~~[add new contour maps and check reedbed layer *etc*]~~.

5.5.1.4 ~~It is expected that in the area of overlap with the Project, Keadby 2 will be approximately 1% of the Critical Load in both cases. The main habitat types affected by these exceedances are reedbeds along the margins of the River Trent. The reedbed habitat is part of the Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) qualifying interest feature of the Humber Estuary SAC and not supporting other species in these areas (eg birds). This habitat is extensive along the southern part of the River Trent in the boundary of the SAC/Ramsar site and is a habitat type~~ Reedbed habitat ~~that~~ is more resilient to the effects of ammonia and nitrogen deposition and along the River Trent it may be subject to inundation also by nutrient rich tidal water. Given the locations of the various projects, it is likely too that areas of overlap will occur along the River Trent to the south west of NLGEP and to the north east of Keadby 2 and 3. Whilst the PC figures set out in the assessment are based on reasonable operating cases for the Project and Keadby 2 at least, it is likely that the areas where effects overlap will be small (*e.g.* see the contour plots in Appendix 3 for the Project ROC).

5.5.1.5 Given the above~~, the air emissions from~~ the effects in-combination of ammonia and deposited nitrogen ~~Project~~ are not predicted to have adverse effects on the European site.

~~*As described in Section 5.2, several of the European sites that are affected by significant or insignificant contributions by Keadby 2, Keadby 3 and the Project have predicted environmental concentrations that exceed their critical levels for ammonia and/or their critical loads for nutrient nitrogen and acid deposition. As a result, any further exposure to atmospheric concentrations of ammonia or to deposition of nutrient nitrogen and acid could have in-combination effects. It is important therefore to consider the wider context, particularly in terms of future trends given the Project Development will not begin to emit until 2028.*~~

~~*5.5.1.2*~~

~~*5.5.2*~~5.5.1 *Baseline Trends*

5.5.1.6 In addition to the above, it is important to consider the wider context, particularly in terms of future trends of atmospheric concentrations, given the Project Development will not begin to emit until 2028.

~~*5.5.2.1*~~ 5.5.1.7 Air quality has been regulated in the UK for many hundreds of years. Modern regulation really began in earnest in the 1950s in response to the widespread pollution episodes (smogs) that afflicted UK cities. More recently regulation has been driven further by the need to improve urban air quality for the protection of health and the need to protect biodiversity in particular from acid rain events linked to UK emissions.

~~*5.5.2.2*~~ 5.5.1.8 These regulatory drivers, alongside social, health and climate change pressures, have seen very substantial reductions in emissions in the UK. The use of coal for power generation has all but disappeared; renewable electricity has further reduced the use of coal, gas, and oil for power; emissions from road vehicles have continuously

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decreased; and industrial emissions have decreased substantially in line with ever more stringent emissions regulations.

~~5.5.2.3~~ 5.5.1.9 In the case of in-combination effects, the principal pollutants of interest emitted by the Project are oxides of nitrogen (NO_x) and nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and ammonia (NH_3), all of which are pollutants in their own right as well as all contributing to acid deposition. Sulphur emitted by the Project is considered in terms of its contribution to acid deposition only as the other developments screened in are not emitters of sulphur. Figure 1~~Figure 1~~ shows the trend in ambient concentrations of NO_2 in the UK 1990 to 2020. This highlights the magnitude of the change, noting that ambient concentrations of rural NO_2 has reduced by more than half in this period.

Figure 1: Pollution Trend NO_2

~~Figure 0.11: Pollution Trend NO_2~~

Figure 1: Annual mean concentrations of NO2 in the UK, 1990 to 2020

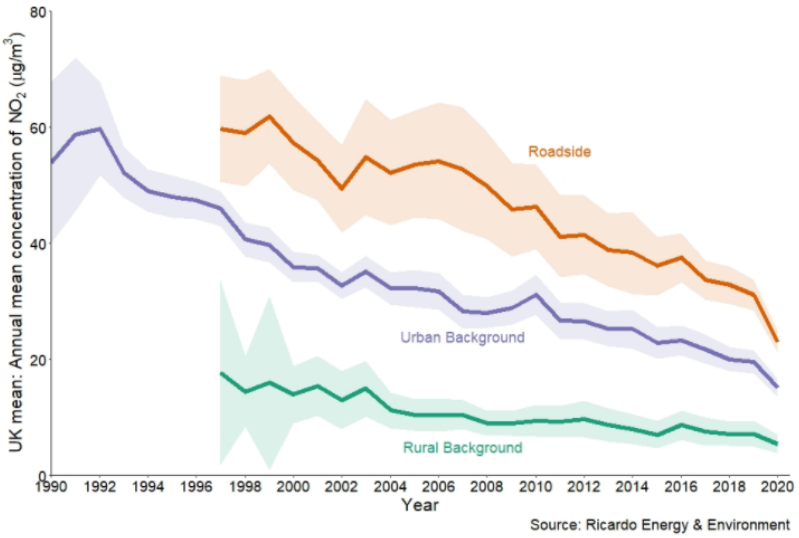
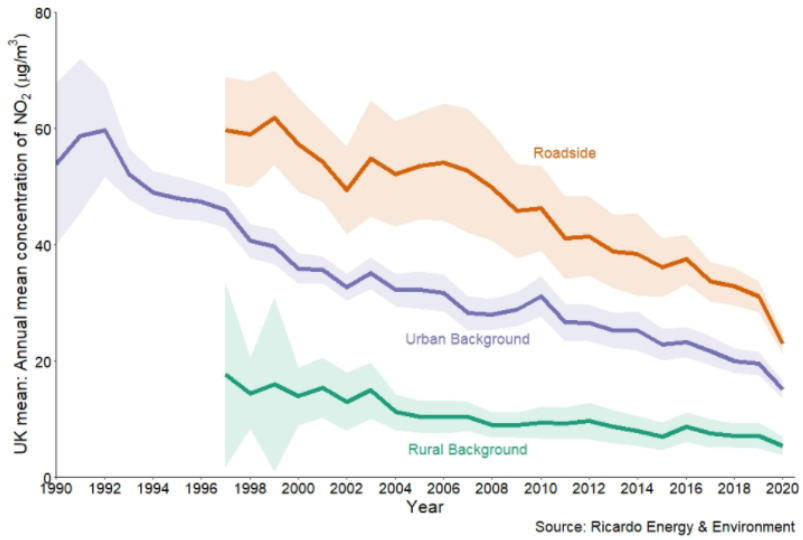


Figure 1: Annual mean concentrations of NO2 in the UK, 1990 to 2020



Source: gov.uk [49]

[49] Office of National Statistics (accessed January 2022) Concentrations of nitrogen dioxide

5.5.1.10

~~5.5.2.4~~ NO_2 emissions, and by definition their contribution to acid and nitrogen deposition, will continue to reduce in the future. The UK remains committed to the European Union's Best Available Techniques Reference Notes (Bref Notes), which will continue to drive down emissions. Vehicle emissions will continue on a downward trajectory, and this will accelerate with the increasing uptake of electric vehicles.

~~5.5.2.5~~ 5.5.1.11 The trend in SO_2 emissions has been even more pronounced than NO_2, with a 97% reduction between 1970 and 2020. The wind down of coal fired power generation, the replacement of domestic coal with gas and electricity, road fuel desulphurisation and the increased regulation of industrial SO_2 emissions has drastically reduced emissions. This is illustrated in Figure 2~~Figure 2~~.

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Figure 20 ~~22~~: Emissions Trend SO_2

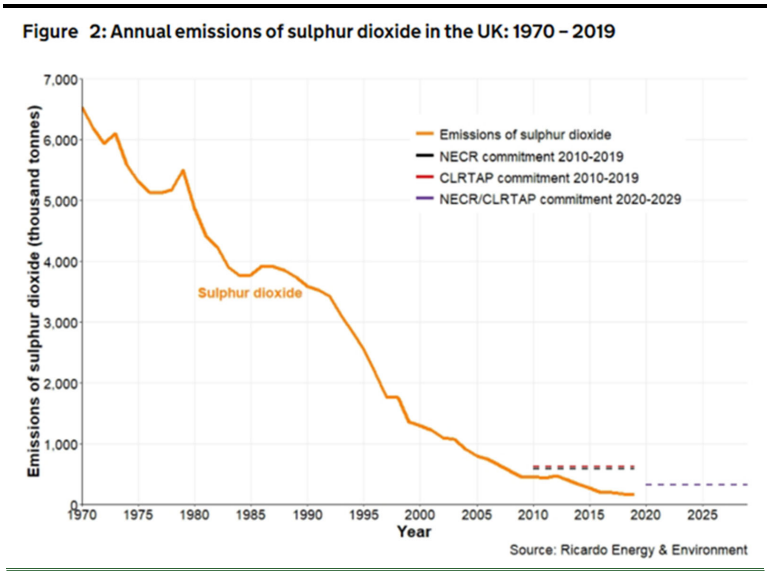

Figure 2: Annual emissions of sulphur dioxide in the UK: 1970 – 2019
Emissions of sulphur dioxide (thousand tonnes)
Year
Emissions of sulphur dioxide
NECR commitment 2010-2019
CLRTAP commitment 2010-2019
NECR/CLRTAP commitment 2020-2029
Sulphur dioxide
Source: Ricardo Energy & Environment

Source: Office of National Statistics[50]

5.5.1.12

[50] Office of National Statistics (accessed January 2022) Emissions of air pollutants in the UK – Sulphur dioxide (SO_2) https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-sulphur-dioxide-so2#:~:text=Emissions%20of%20sulphur%20dioxide%20have,level%20in%20the%20time%20series.&text=The%20UK%20meets%20the%20current,the%20period%202010%20to%202019.

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~~5.5.2.6~~ SO_2 emissions, and their contribution to acid deposition, will also continue to reduce. Clearly the trend will be less than previously due to the huge gains made in emissions reductions over the last fifty years, but improvements, for example driven through the Bref process and uptake of zero carbon technologies will continue.

~~5.5.2.7~~ 5.5.1.13 The trend in emissions of ammonia to air are far less pronounced compared to NO_2 and SO_2. The trends in ammonia emissions are shown in Figure 3~~Figure 3~~.

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Figure 30.33: Emissions Trend NH3

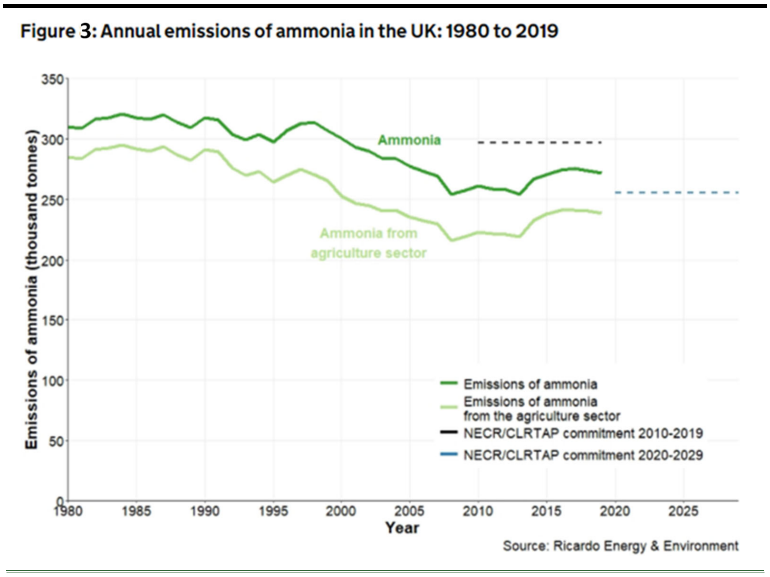

Figure 3: Annual emissions of ammonia in the UK: 1980 to 2019
Emissions of ammonia (thousand tonnes)
Ammonia
Ammonia from agriculture sector
Emissions of ammonia
Emissions of ammonia from the agriculture sector
NECR/CLRTAP commitment 2010-2019
NECR/CLRTAP commitment 2020-2029
Year
Source: Ricardo Energy & Environment

5.5.1.14 ~~5.5.2.8~~ By far the greatest source of ammonia emissions is agriculture with over 80% of emissions from this sector. The trend at the moment is, if anything, towards higher emissions. However, the agricultural sector has been paid scant attention in terms of the emissions to air with little meaningful regulation of emissions. Agricultural emissions are specifically picked up as a key topic in the UK Government's 2019 Air Quality Strategy. The strategy sets out national policy to address ammonia emissions from agriculture with the specific intention of driving these downwards.

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~~5.5.3~~5.5.2 Summary of ~~Conclusions on~~ In-combination Effects on European Sites

5.5.2.1 Based on the above, no adverse effects on European sites are predicted from the effects of ammonia and deposited nitrogen due to the Project in-combination with Keadby 2 and Keadby 3.

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~~5.5.3.1~~ 5.5.2.2 Whilst not essential to the finding above, it is important to note ongoing changes in baseline conditions~~Clearly UK emissions, and their contribution to acid and nutrient nitrogen deposition, will be dominant at the designated sites close to the project. However, t~~Transboundary pollution also contributes to the overall pollution burden and acid and nitrogen deposition in the UK. Emissions from the European Union (EU) dominate transboundary emissions of NO_x/NO_2, SO_2 and NH_3. Similar to the UK, there have been substantial reductions in emissions and airborne concentrations of pollutants across the EU. These improvements have been driven by the same drivers as exist in the UK and will also continue in the future.

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~~5.5.3.2~~ 5.5.2.3 ~~In addition to the wider baseline it is also worth considering the likely changes to emissions and ambient concentrations in closer proximity to the Project. There are~~ Despite new emission sources in the form of Keadby 2 and Keadby 3 gas fired power plants a few kilometres to the southwest of the Project, ~~. However,~~ there are several notable emission reductions, for example the Keadby 1 gas fired power station that has been taken completely off-line. It had emissions limits at least twice that of the new Keadby plants. The fleet of coal fired power plants that once dominated the Trent valley are all defunct now or very soon will be, Drax has moved to biomass with lower emissions of SO_2 in particular and Scunthorpe steelworks is required to meet BAT through the Bref process, further reducing emissions. The regional vehicle and transportation emissions continue to reduce, mirroring the national trend.

~~5.5.3.3~~ 5.5.2.4 When the international, national, and local factors are all combined, a clear trend emerges that emissions and ambient concentrations, and therefore associated acid and nitrogen deposition, ~~-~~ have reduced massively over the last 50 years and will continue to decrease. Whilst there have been 'big wins' in industry in the last 50 years, the downward trend will continue with the further uptake of BAT at industrial sites and further improvements in traffic and uptake of electrical vehicles. The Low Carbon Economy (LCE) may also further accelerate emissions reductions as industries move towards low and zero carbon technologies, further removing combustion sources.

5.5.2.5 When taken in this wider context, there are ~~it is~~ clear and ~~that the~~ continuing~~ed~~ improvements also in baseline air quality and deposition ~~described above~~ in a local context~~, are important in assessing whether there are likely to be any adverse effects on European site integrity from in-combination effects.~~

~~5.5.3.4 The effects of the project alone are predicted not to have adverse effects on the site integrity of the Humber Estuary SAC, SPA or Ramsar site, Thorne Moor SAC or Thorne & Hatfield Moors SPA, for the reasons described in Section 5.2 above. Whilst Keadby 2 and 3 power plants are both much larger emitters than the Project, it is clear that the new emissions from them will be offset by the closure of Keadby 1, the changes to the other facilities described and other continuing improvements to the background levels and loads. Hence adverse effects on the integrity of these European sites are not predicted as a result of emissions to air and associated acid and nitrogen deposition in-combination with other developments.~~

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APPENDIX A FIGURESAIR QUALITY REASONABLE URCING OPERATING CASE (ROC)

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NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

North Lincolnshire Green Energy Park

Air Quality Reasonable Operating Case

March 2023

Project No.: EN010116

The business of sustainability

ERM

Project title	North Lincolnshire Green Energy Park
Document title	Air Quality Reasonable Operating Case
PINS No.	EN010116
Date	March 2023
Version	1.0
Author	Rachel Nguyen
Client Name	North Lincolnshire Green Energy Park

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	00	Rachel Nguyen	Chris Hazell-Marshall	Name	00.00.0000	Text

March 2023

North Lincolnshire Green Energy Park

Air Quality Reasonable Operating Case

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CONTENTS

List of Tables

Acronyms and Abbreviations

Name	Description
ACC	Air Cooled Condensers
AGI	Above Ground Installation
BAT	Best Available Techniques
BEIS	Department for Business, Energy and Industrial Strategy
BGS	British Geological Society
BMVL	Best and Most Versatile Land
BREF	EU Best Available Techniques reference notes
C4SL	Category 4 Screening Levels
CBMP	Concrete Block Manufacturing Plant
CBR	California Bearing Ratio tests
CDM	Construction Design and Management
CHP	Combined Heat and Power
CIEH	Chartered Institute of Environmental Health
CIfA	Chartered Institute for Archaeologists

CIRIA	Construction Industry Research and Information Association
CLEA	Contaminated Land Exposure Assessment
CO_2	Carbon Dioxide
CoCP	Code of Construction Practice
CSM	Conceptual Site Model
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DHN	District Heat Network
DHPWN	District Heat and Private Wire Network
dML	deemed Marine Licence
DMRB	Design Manual for Roads and Bridges
DoW:CoP	Definition of Waste: Code of Practice
DQRA	Detailed Quantitative Risk Assessment
EIA	Environmental Impact Assessment
EMFs	Electric and Magnetic Fields
EPA	Environmental Protection Act
EPH	Extractable Petroleum Hydrocarbons
EPR	Environmental Permitting Regulations
ERF	Energy Recovery Facility
ERM	Environmental Resources Management
ES	Environmental Statement
EU	European Union
EUS	Extensive Urban Survey
EV	Electric Vehicle
FGTr	Flue Gas Treatment residue
GAC	Generic Assessment Criteria
GI	Ground Investigation
GQRA	General Quantitative Risk Assessment
H_2	Hydrogen
HE	Historic England
HER	Historic Environment Record

HRA	Habitat Regulations Assessment
HSE	Health and Safety Executive
IBA	Incinerator Bottom Ash
IED	Industrial Emissions Directive
IPC	Integrated Pollution Control
IPPC	Integrated Pollution and Prevention Control
LDF	Local Development Framework
LPA	Local Planning Authority
LQM	Land Quality Management
M bgl	Metres below ground level
MCA	Mineral Consultation Area
MCAA	Marine and Coastal Access Act
MHCLG	Ministry for Housing, Communities and Local Government
MMO	Marine Management Organisation
MSA	Mineral Safeguarding Area
MWHe	Electrical generation in megawatt-hours (electric)
MWhth	Heat generation in megawatt-hours (thermal)
NHLE	National Heritage List for England
NLC	North Lincolnshire Council
NLGEP	North Lincolnshire Green Energy Park
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
PA	Planning Act
PAC	Potential Area of Concern
PAH	Polycyclic Aromatics Hydrocarbons
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPE	Personal Protective Equipment
PPG	Planning Practice Guidance
PRF	Plastic Recycling Facility
PV	Photovoltaic
PWN	Private Wire Network

QRA	Qualitative Risk Assessment
RDF	Refuse Derived Fuel
RHTF	Residue Handling and Treatment Facility
S21	Solar 21
S4UL	Suitable 4 Use Levels
SAC	Special Area of Conservation
SGV	Soil Guideline Value
SI	Site Investigation
SOCC	Statement of Community Consultation
SoS	Secretary of State
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TCPA	Town and Country Planning Act
UAD	Urban Archaeological Database
UK	United Kingdom
WFD	Waste Framework Directive
WMP	Waste Management Plan
WID	Waste Incineration Directive

1. INTRODUCTION

1.1 Overview

The Air Quality Impact Assessment (AQIA) material originally prepared to support the assessment of air quality impacts on ecology adopted a Rochdale Envelope approach. This included a number of assumptions, which on further consideration were overly conservative. These assumptions included:

- the ERF plant would always emit at emission limits;
- 100% of materials would be transported by road;
- 100% of materials would be transported by ship; and
- 100% of materials would be transported by rail.

The initial AQIA identified potentially significant contributions to impacts on ecology. Of note is that several of these impacts were marginally above the threshold applied in the assessment and are unlikely to arise in practice because the conservative assumptions effectively added several worst cases together. Therefore, to provide more detailed information a 'Reasonable Operating Case' (ROC) has been modelled to better understand the likely air quality impacts of the Project. The purpose is to allow a more refined understanding of the actual likely impacts and effects on ecological receptors.

If further information is required on the modelling approach reference where necessary should be made to the original AQIA (REP4-009). Information already presented has not been repeated, and instead this appendix focusses only on where there are changes to operating conditions, emissions data and subsequent impacts.

2. CHANGES TO ASSESSMENT PARAMETERS

The updated AQIA utilises detailed dispersion modelling to predict the potential impacts on air quality as a result of emissions from the process and associated transport. Two models have been used: ADMS-5 for point source emissions; and ADMS-Roads for road traffic sources. The results of these models are then combined to provide a comprehensive understanding of air quality impacts at sensitive receptors. All model parameters are unchanged from the AQIA set out in the REP4-009, unless specifically noted below as having been changed. Worst case meteorological data have been used.

- ERF plant changes:
  - Emissions of HCl, NO_x, SO_2 and NH_3 amended. In the EIA these were assumed to arise at emission limits, whereas in the ROC these are modelled at the likely actual emissions.
  - Reasonable case emissions are based on Environment Agency annual ERF performance data [1], and extrapolated for NO_x and NH_3 emissions data pro-rated to meet the upcoming Bref emissions limits [2].
- Back-up generator - there are no changes to emissions data.
- ERF boilers - there are no changes to emissions data.
- Vessel movements are based on 24% of Project material movements (including RDF, aggregate, blocks) being by ship:
  - 290 ships per year.
  - Ships on the wharf for 9 hours each day a ship is on berth (this is the period between high tides).
  - Ship engine is running at 30% of full power when at the wharf-side to provide ship electrical power.
- RDF and aggregate delivery trains:
  - One train per day hauled by one class 66 locomotive.
- Operational road traffic changes are:
  - In the EIA case only traffic using the new access road was modelled. No account was taken for the reduction in impacts at River Trent ecological receptors due to the severance of the current access road past Neap House.
  - The updated assessment:
    - Modelled the existing road via Neap House, 2028 base case.
    - Modelled new access road, 2028 with project case.
    - Amended traffic data to reflect reasonable case traffic, capturing reasonable case ship and rail movements.

[1] Environment Agency (accessed February 2023) 2021 Incineration Monitoring Reports https://environment.data.gov.uk/portalstg/home/item.html?id=50518e4e4c8a4d81b029281a89202d34

[2] Hitach Zosen Inova (accessed February 2023) DyNOR® The SNCR Process That Fulfils Europe's Strict Nitrogen Oxide Standards https://www.hz-inova.com/files/2018/05/DyNOR_EN_online.pdf

- Modelling assessed net change in impacts with severing of Neap House access road and opening of new access road, noting that the new access road is to the east of the existing route and further inland from ecological receptors at the River Trent.

Table 2.1 sets out the changes made in the 'Reasonable Operating Case' AQIA compared to the REP4-009.

Table 2.1 Comparison of EIA and 'Reasonable Case' Model Basis

Item	Planning Case	Reasonable Case
ERF emissions		
SO_2 emissions (mg/Nm^3)	30	17.02
SO_2 emissions (g/s)	1.7	0.962
NO_x emissions (mg/Nm^3)	120	120
NO_x emissions (g/s)	6.78	6.78
HCl emissions (mg/Nm^3)	6.0	4.3
HCl emissions (g/s)	0.339	0.242
NH_3 emissions (mg/Nm^3)	10	4.0
NH_3 emissions (g/s)	0.565	0.226
Operating hours	24 hours per day all year round at full load	8,000 hours per annum (to allow for down time and maintenance) at full load
Ship	50% of year, ship on wharf 30% engine load	290 days/year, 9 hours per day ship on wharf 30% engine load
Rail	3 trains per day	1 train per day
Road	100% material transport by road	Road traffic levels were recalculated to take into account transport on ship and rail

It should be noted that the above transport modal splits represent a likely long-term average (e.g. over one year) and not maxima in any one day or week. It should also be noted that the ship, rail and road traffic numbers were calculated for an RDF fuel consumption of 760,000 tonnes per annum, with usages of reagents and production of residues based on this throughput. This is still a worst case and the average annual tonnage is likely to be less than this value.

3. RESULTS AND SUMMARY

The results of the ROC air quality model are not set out here. Instead they have been used to inform a more detailed analysis of the potential impacts on ecological receptors in the HRA report.

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APPENDIX B HRA MATRICES

Subject to ongoing review

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APPENDIX C FIGURES

~~Date: May 2022~~

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 1.1 SPA and Ramsar Birds (Excluding birds in Flight) (Wintering and Migratory Surveys 2018 – 2022)

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	20/03/2023
Drawn by	MTC
Checked by	KOC
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	11,000
ArcMap File	

0664595_ES_WinteringBirds_ExcludingFlight_A01

Legend

Order Limits

Wintering Birds Not in Flight

- Golden Plover - 425 birds, 6 records
- Lapwing - 158 birds, 14 records
- Mallard - 493 birds, 94 records
- Oystercatcher - 5 birds, 3 records
- Redshank - 19 birds, 10 records
- Teal - 4 birds, 2 records

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

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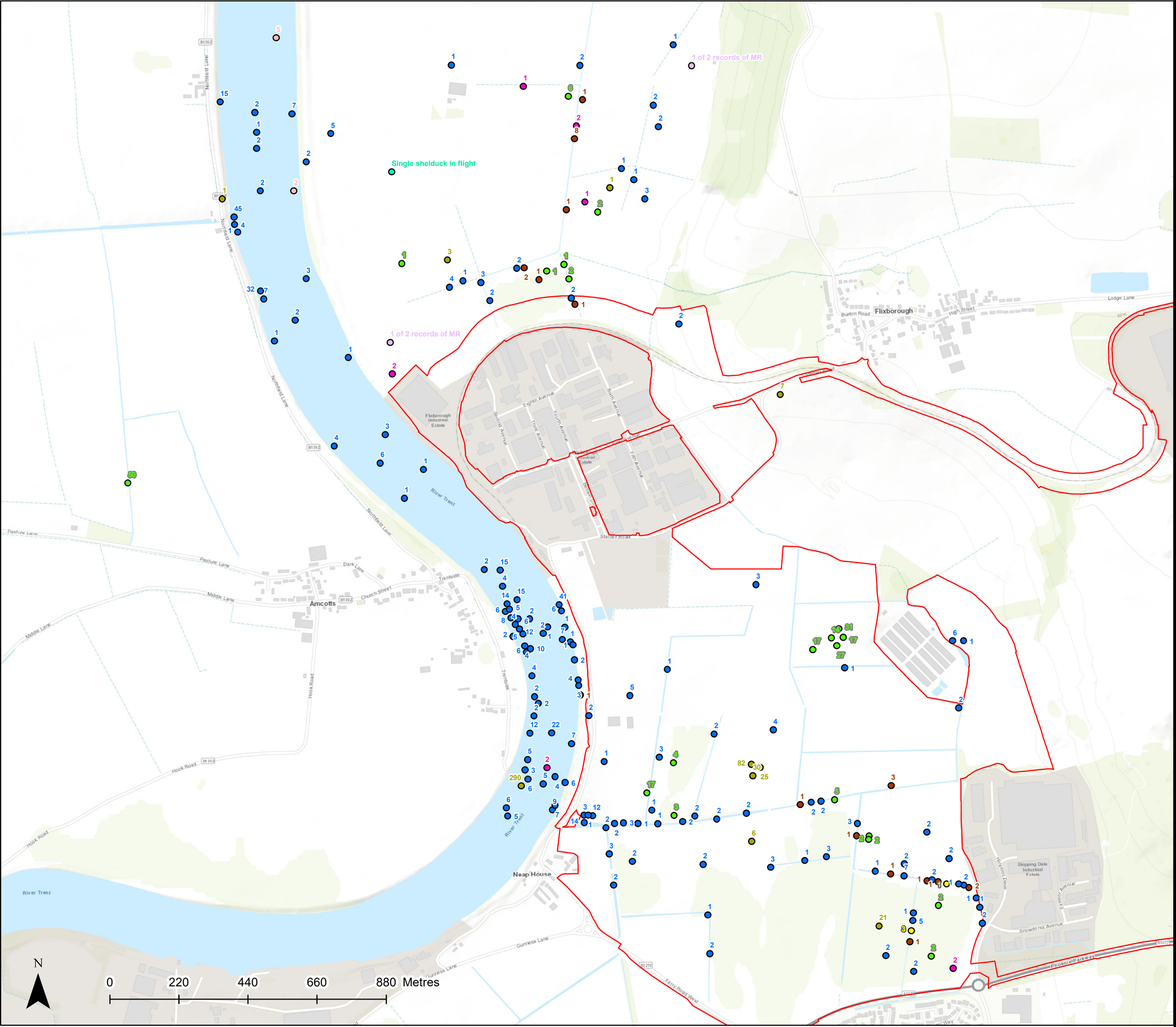

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 1.2 SPA and Ramsar Birds (All Records) (Wintering and Migratory Surveys 2018 – 2022)

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	20/03/2023
Drawn by	MTC
Checked by	KOC
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	11,000
ArcMap File	

0664595_ES_WinteringBirds_AllRecords_A01

Legend

Order Limits

Wintering Birds All Records

- Curlew - 7 birds, 2 records
- Golden Plover - 466 birds, 10 records
- Lapwing - 206 birds, 20 records
- Mallard - 610 birds, 135 records
- Marsh Harrier - 2 birds, 2 records
- Oystercatcher - 10 birds, 6 records
- Redshank - 26 birds, 15 records
- Shelduck - 1 bird total
- Teal - 4 birds, 2 records

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

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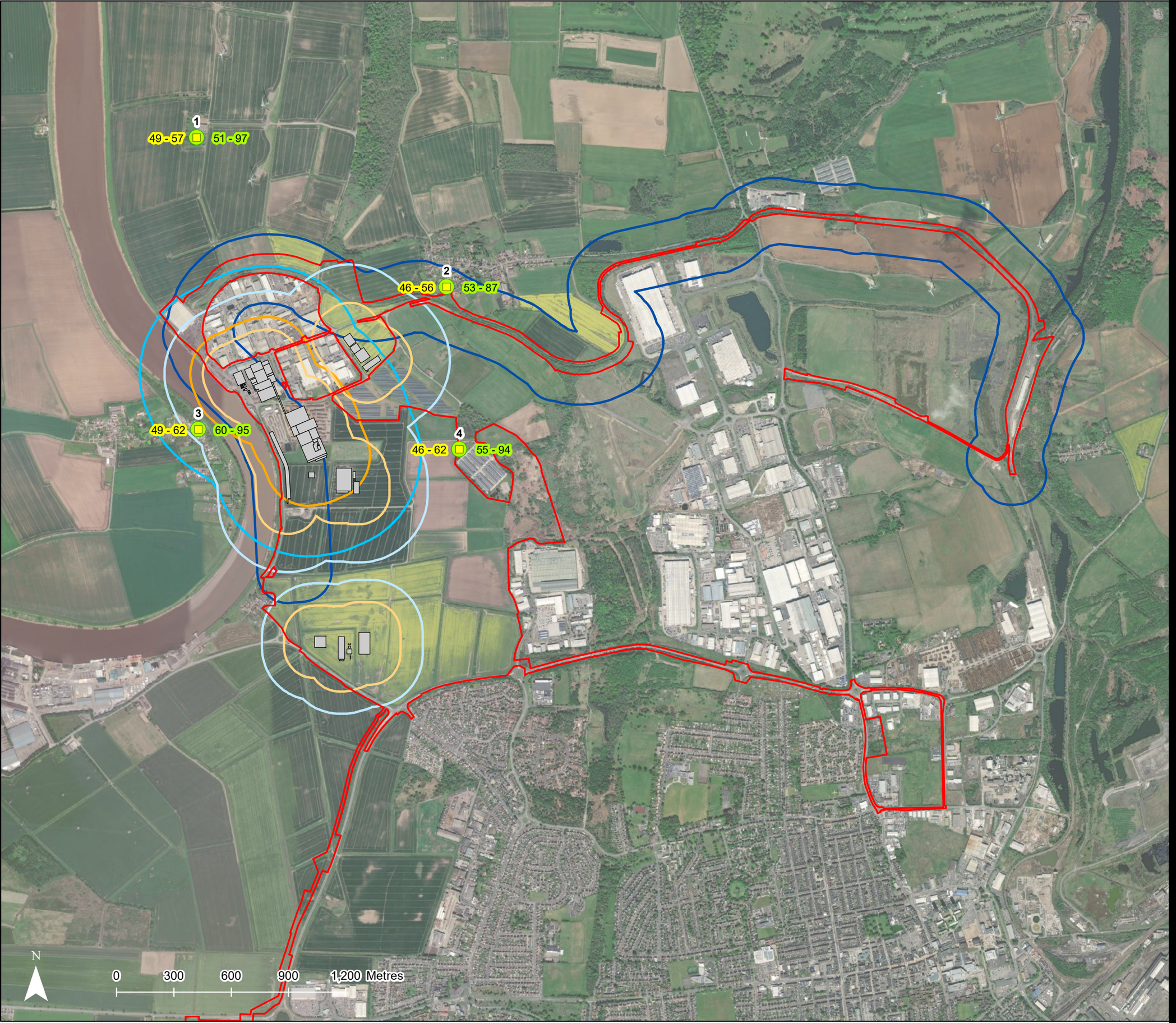

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Buffers showing estimated zone of construction noise above 55dB, LAeq,12h. To be read in conjunction with SoCG. For main building construction and breaking activities, a 10dB reduction for mitigation has been assumed.

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	25/01/2023
Drawn by	MTC
Checked by	JH
Version	A01

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	18,000
ArcMap File	\\uksprdgisfs01\Data\London\Confidential Projects\0483091 - Solar 21\MAPS\NOISE\0664595 NOISE_ConstructionNoiseBuffers_A01

Legend

Baseline Noise Locations:

- Range of measured daytime $L_{Aeq,16h}$ levels, dB
- Range of measured daytime $L_{Amax,15min}$ levels, dB
- Order Limits
- Buildings or Compounds
- Mitigated Main Building Construction 159m Buffer
- Mitigated Breaking 224m Buffer
- Unmitigated Main Building Construction 359m North Buffer, 275m South Buffer
- Unmitigated Breaking 489m Buffer
- Unmitigated RailwayWorks 158m Buffer

Main Building Construction (assumes 10dB reduction for mitigation is achievable)
Breaking (assumes 10dB reduction for mitigation is achievable)

Layer Source Information

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 4 European Sites

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MTC
Checked by	SD
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	120,000
ArcMap File	\\UKSSMBNAF- HRA_ES_DesignatedSites_15kmBuffer_A01

Legend

- Stack Location
- Order Limits
- 15km Buffer from Stack Location
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Ramsar Site
- Special Protection Area (SPA)

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

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Humber Estuary
Humber Estuary
Humber Estuary
Humber Estuary
Thorne Moor
Thorne, Crowle and Goole Moors
Thorne & Hatfield Moors
Eastoft Meadow
Crowle Borrow Pits
Belshaw
Epworth Turbary
Messingham Heath
Messingham Sand Quarry
Manton and Twigmoor
Tuetoes Hills
Scotton and Laughton Forest Ponds
Risby Warren
Broughton Far Wood
Broughton Alder Wood

N

0 3,000 6,000 9,000 12,000 Metres

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 5 Designated Sitse In-combination 15km Buffer

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MTC
Checked by	KM
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	200,000
ArcMap File	\\UKSSMBNAF-

HRA_ES_DesignatedSites_InCombination_15kmBuffer_A01

Legend

- Project Locations
- Stack Location
- Order Limits
- 15km Buffer from Stack
- 15km Buffer from Designated Sites
- Site of Special Scientific Interest
- Special Area of Conservation
- Ramsar Site
- Special Protection Area

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

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Energy Works, Hull
Humber Estuary
Humber Estuary
Humber Estuary
Humber Estuary
Thorne Moor
Thorne, Crowle and Goole Moors
Thorne & Hatfield Moors
Eastoft Meadow
Risby Warren
N2 (Keadby 3)
S1 (Keadby 2)
Crowle Borrow Pits
Broughton Far Wood
Broughton Alder Wood
Doncaster ERF
Belshaw
Epworth Turbary
Messingham Heath
Messingham Sand Quarry
Manton and Twigmoor
Tuetoes Hills
Scotton and Laughton Forest Ponds
N
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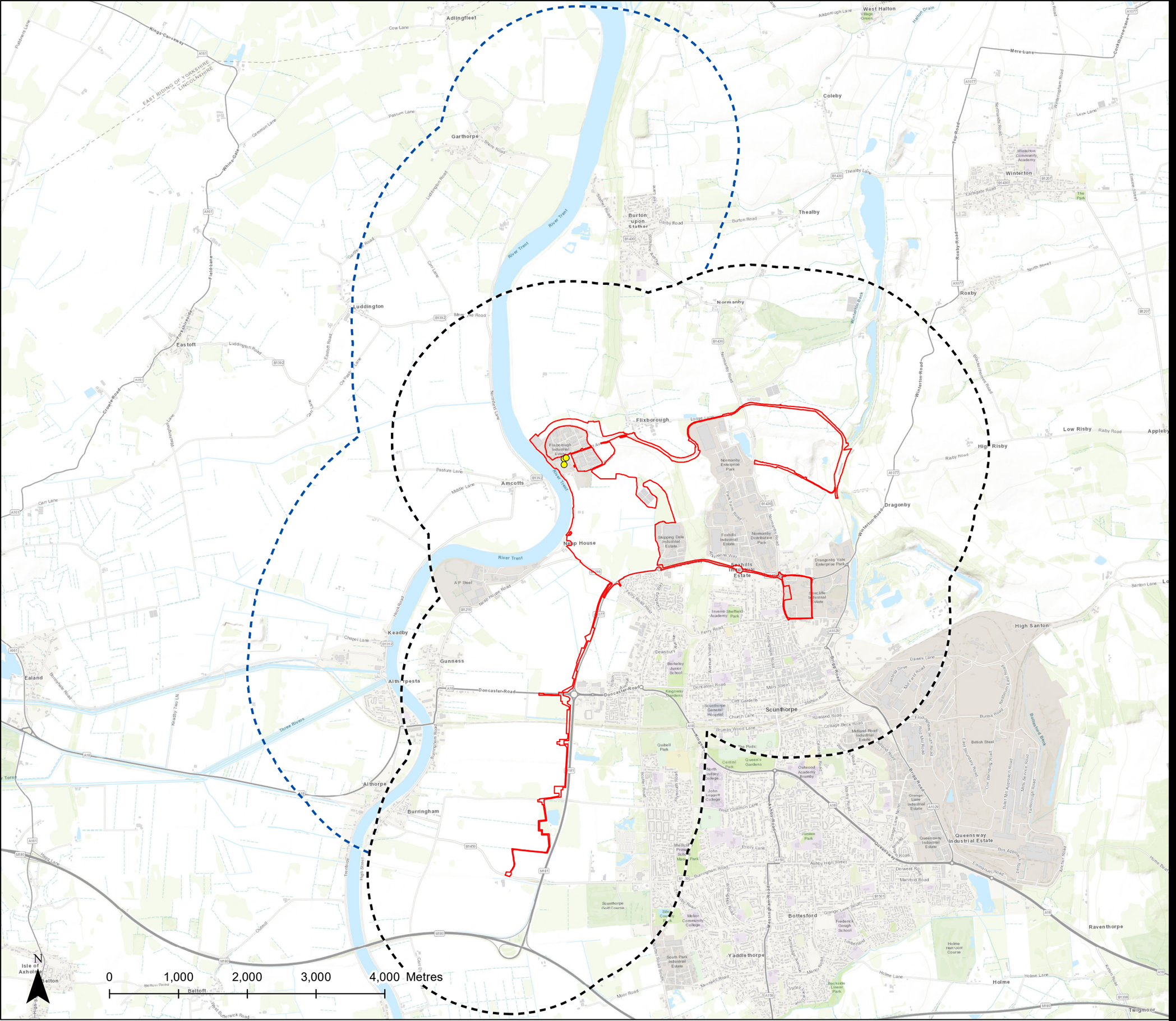

NORTH LINCOLNSHIRE GREEN ENERGY PARK

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Title	Figure 6 Search Area for In-combination Effects

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	16/03/2022
Drawn by	MTC
Checked by	SD
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	50,000
ArcMap File	\\UKSSMBNAF-HRA_ES_DesignatedSites_InCombination_2kmBuffer_A01

Legend

- Stack Location
- Order Limits
- Order Limits 2km Buffer
- 2km Buffer from Designated Sites Beyond Order Limits 2km Buffer

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c)

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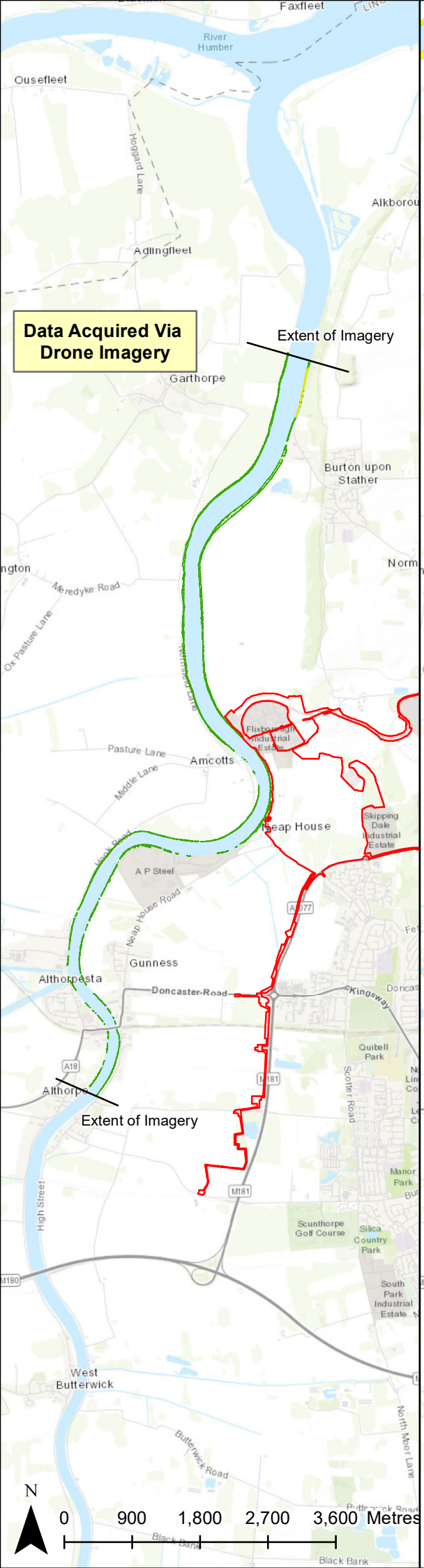

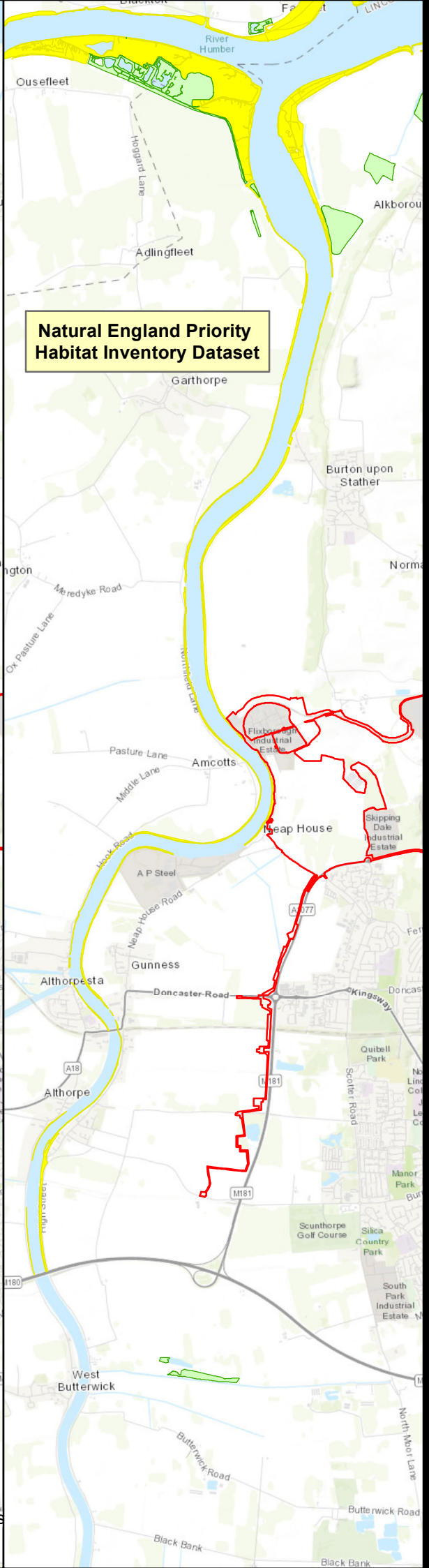

NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title Figure 7
Reedbed Comparison

Client Information

Client	North Lincolnshire Green
PINS Proj No	Energy Park Ltd.
Date	EN010116
Drawn by	16/03/2022
Checked by	MTC
Version	SD

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	70,000

ArcMap File

\\UKSSMBNAF-

HRA_ES_ReedbedComparison_A01

Legend

- Order Limits
- Reedbeds
- Coastal

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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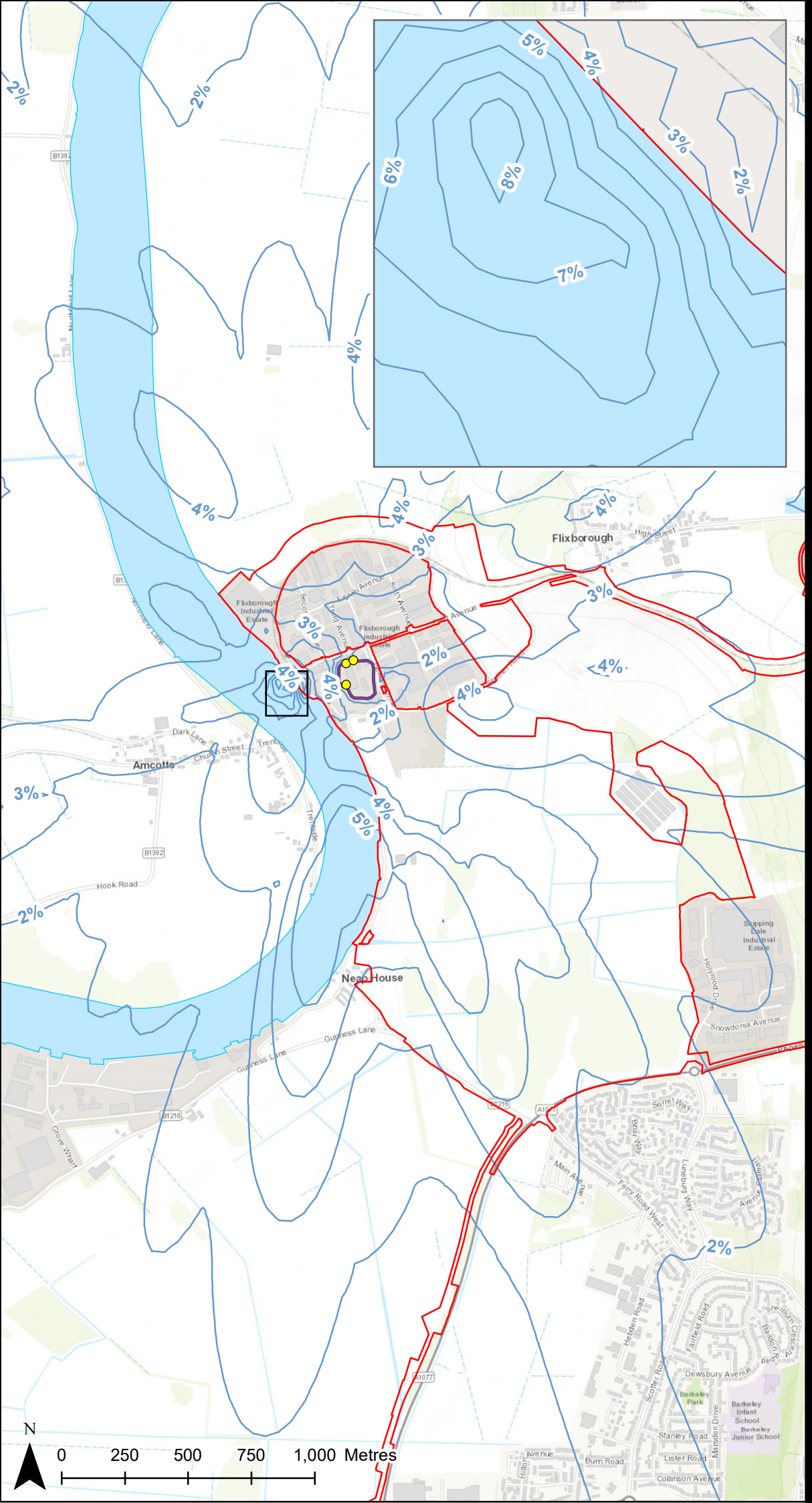

NORTH LINCOLNSHIRE GREEN ENERGY PARK

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North Lincolnshire Green Energy Park

Title	Figure Predicted 24hr NO_x Levels (% PC) at Humber Estuary SAC

Client Information

Client	North Lincolnshire Green Energy Park Ltd.
PINS Proj No	EN010116
Date	10/03/2023
Drawn by	MTC
Checked by	KOC
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	20,000

ArcMap File

\\uksprdgisfs01\Data\London\Confidential Projects\0483091 - Solar

AQ_ReasonableCaseModel_V6_Humber_NOX24hrCL200_A01

Legend

- Stack Location

Reasonable Operating Case (ROC): NOx (24hr) Contour Plot: PC as % of Critical Level (CL200). CL = 200 µg m^{-3}

- 1% interval
- 1% contour
- Order Limits
- Special Area of Conservation (SAC)

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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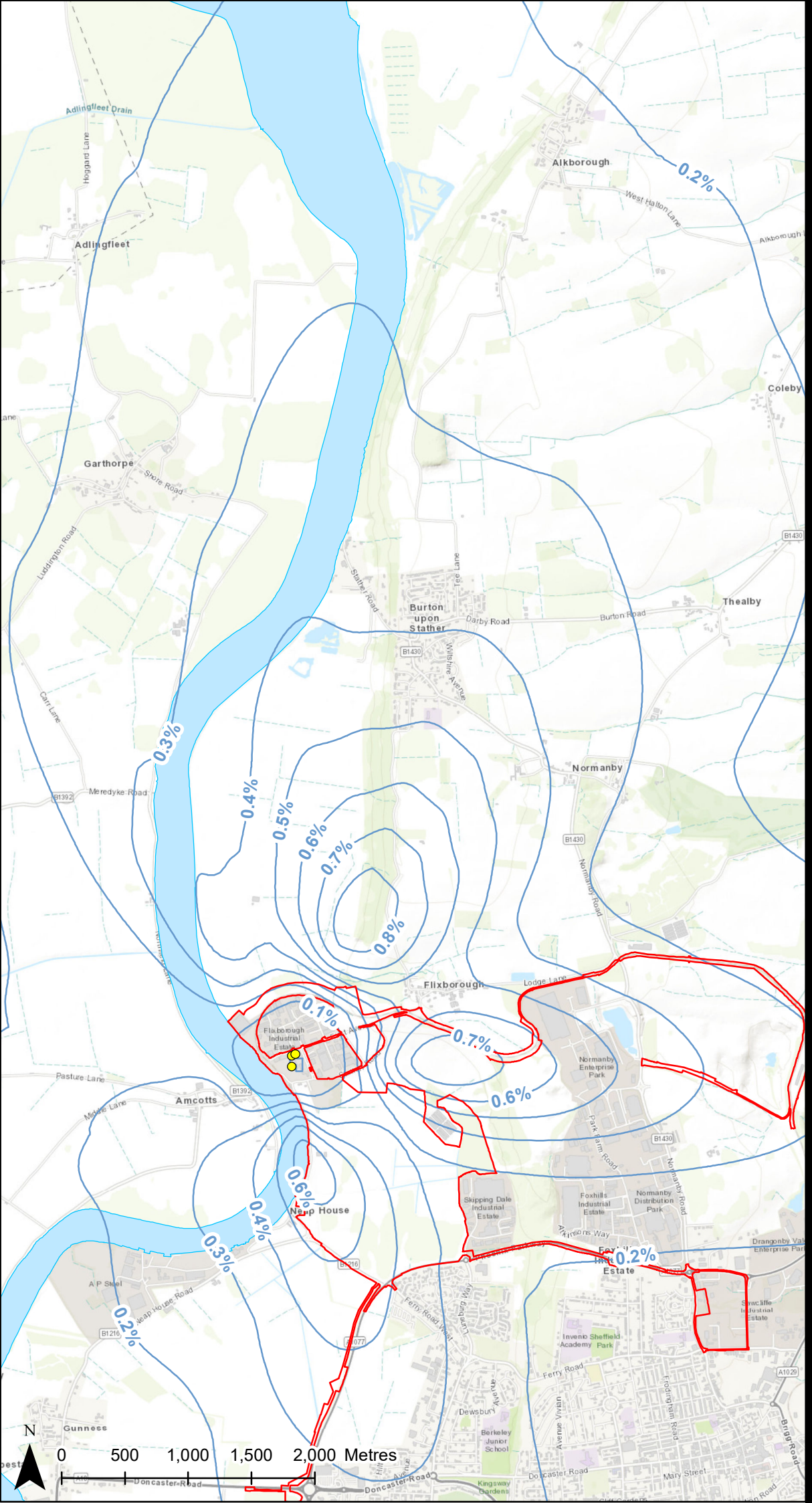

NORTH LINCOLNSHIRE GREEN ENERGY PARK

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Title	Figure Predicted Ammonia Levels (% PC) at Humber Estuary SAC

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	10/03/2023
Drawn by	MTC
Checked by	KOC
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	40,000

ArcMap File

\\uksprdgisfs01\Data\London\Confidential Projects\0483091 - Solar

AQ_ReasonableCaseModel_V6_Humber_AmmoniaCL3_A01

Legend

- Stack Location
- Order Limits

Reasonable Operating Case (ROC): Ammonia Contour Plot: PC as % of Critical Level (CL3). CL = 3 µg m^{-3}

- 0.1% intervals
- Special Area of Conservation (SAC)

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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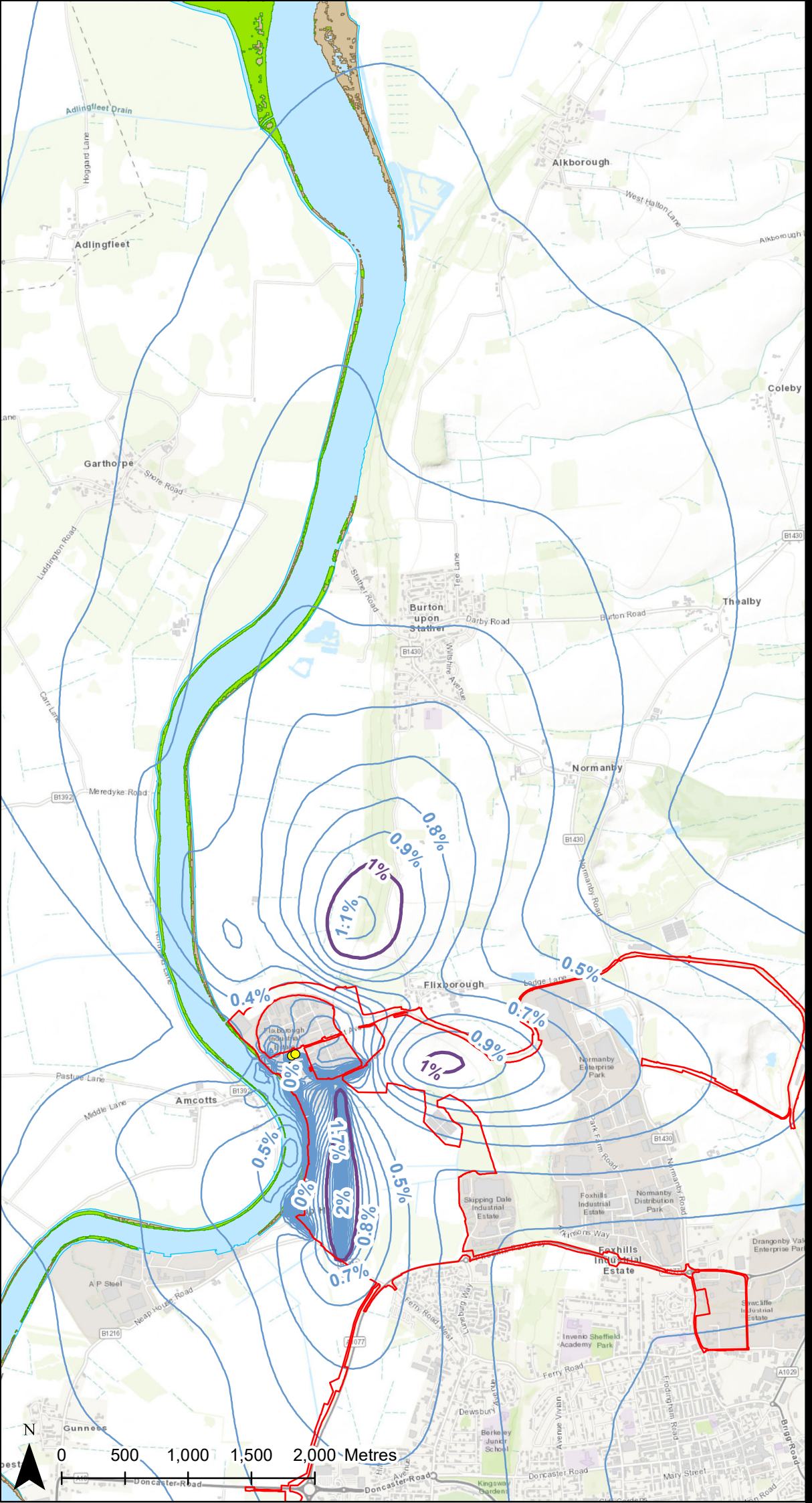

NORTH LINCOLNSHIRE GREEN ENERGY PARK

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North Lincolnshire Green Energy Park

Title	Figure Predicted Nitrogen Deposition (% PC) at Humber Estuary SAC - Upper Saltmarsh and Reedbed Habitats

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	10/03/2023
Drawn by	MTC
Checked by	KOC
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	40,000

ArcMap File

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AQ_ReasonableCaseModel_V6_Humber_NitrogenCL20_A01

Legend

- Stack Location

Reasonable Operating Case (ROC): Nutrient Nitrogen Contour Plot: PC as % of Critical Load (CL20) (min)

- 0.1% interval
- 1% contour
- 1% interval
- Order Limits
- Special Area of Conservation (SAC)
- Reedbeds
- Upper Saltmarsh

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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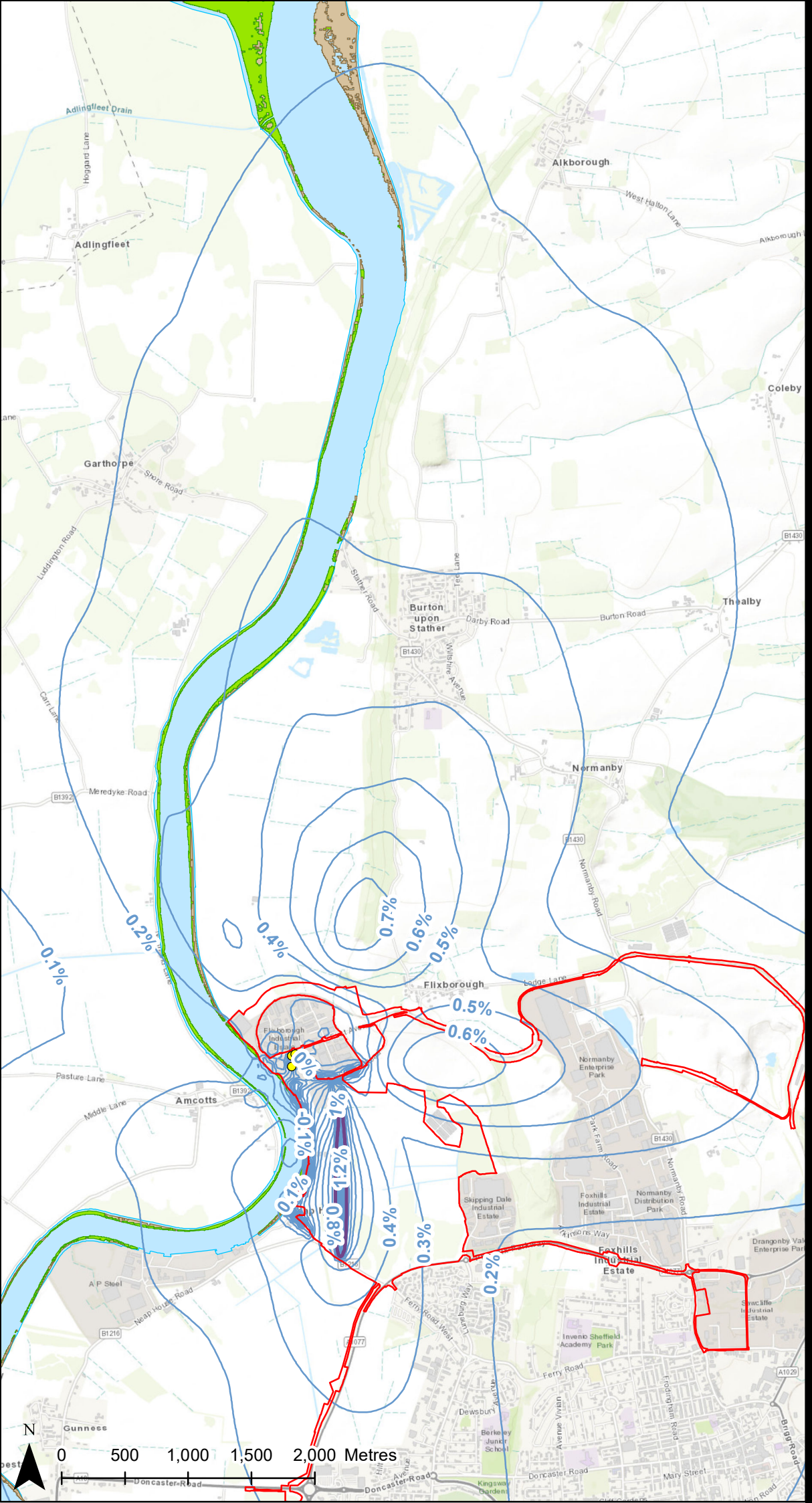

NORTH LINCOLNSHIRE GREEN ENERGY PARK

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North Lincolnshire Green Energy Park

Title Figure
Predicted Nitrogen Deposition (% PC) at Humber Estuary SAC - Upper Saltmarsh and Reedbed Habitats

Client Information

Client	North Lincolnshire Green Energy Park Ltd
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Date	10/03/2023
Drawn by	MTC
Checked by	KOC
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	40,000

ArcMap File

\\uksprdgisfs01\Data\London\Confidential Projects\0483091 - Solar

AQ_ReasonableCaseModel_V6_Humber_NitrogenCL30_A01

Legend

- Stack Location

Reasonable Operating Case (ROC): Nutrient Nitrogen Contour Plot: PC as % of Critical Load (CL30) (min)

- 0.1% interval
- 1% contour
- Order Limits
- Special Area of Conservation (SAC)
- Reedbeds
- Upper Saltmarsh

Layer Source Information

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI,

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~~Figure 0.44: European Sites~~

Figure 0.55: Proposed Large-scale Combustion Projects that are within a 15km buffer of the Project's Main Emissions Sources and others within a further 15km of European Protected Sites that occur within the Buffer

~~Figure 0.66: Proposed Large-scale Combustion Projects that are within a 2km buffer of the Project's Main Emissions Sources and others within a further 2km of European Protected Sites that occur within the Buffer~~

~~Figure 0.77: Reedbed Comparison~~

~~Figure 0.88: Contours NO_x 24 Hour~~

Figure 0.99: Contours NH_3 Annual

~~Figure 0.1010: Contours ND Grassland~~

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Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
Myanmar
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Senegal
Singapore
South Africa
South Korea
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Sweden
Switzerland
Taiwan
Tanzania
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