

The Keadby 3 Low Carbon Gas Power Station Project

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**The Keadby 3 (Carbon Capture Equipped Gas Fired Generating
Station) Order**

**Land at and in the vicinity of the Keadby Power Station site,
Trentside, Keadby, North Lincolnshire**

Habitats Regulations Assessment Screening Report

The Planning Act 2008

**The Infrastructure Planning (Applications: Prescribed Forms and
Procedure) Regulations 2009 – Regulation 5(2)(g)**

**Conservation of Habitats and Species Regulations 2017 (as
amended)**

Applicant: Keadby Generation Limited

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GLOSSARY

Abbreviation	Description
AADT	Annual Average Daily Traffic - a measure of the total volume of vehicle traffic of a highway or road for a year divided by 365 days.
ADMS	Atmospheric Dispersion Modelling System - a proprietary model for the assessment of effect of emissions to air from point sources and road sources.
AIA	Atmospheric Impact Assessment
AIL	Abnormal Indivisible Load - a load that cannot be broken down into smaller loads for transport without undue expense or risk of damage. It may also be a load that exceeds certain parameters for weight, length and width.
APIS	Air Pollution Information System - provides a comprehensive source of information on air pollution and the effects on habitats and species. It supports the assessment of potential effects of air pollutants on habitats and species.
Applicant	Keadby Generation Limited.
BAT	Best Available Techniques
CCGT	Combined Cycle Gas Turbine – a CCGT is a combustion plant where a gas turbine is used to generate electricity and the waste heat from the flue-gas of the gas turbine is converted to useful energy in a heat recovery steam generator (HRSG), where it is used to generate steam. The steam then expands in a steam turbine to produce additional electricity.
CEMP	Construction Environment Management Plan - a plan to outline how a construction project will avoid, minimise or mitigate effects on the environment and surrounding area.
CERC	Cambridge Environmental Research Consultants
CIEEM	Chartered Institute of Ecology and Environmental Management
CJEU	Court of Justice of the European Union - interprets EU law to ensure it is applied in the same way in all EU countries.
DCO	Development Consent Order - made by the relevant Secretary of State pursuant to the Planning Act 2008 to authorise a Nationally Significant Infrastructure Project. A DCO can incorporate or

Abbreviation	Description
	remove the need for a range of consents which would otherwise be required for a development. A DCO can also include rights of compulsory acquisition.
DML	Deemed Marine Licence
EC	European Commission - the executive branch of the European Union.
EclA	Ecological Impact Assessment - a process by which the potential ecological impacts of a development proposal are assessed.
EEA	European Economic Area - allows countries to be part of the EU's single market.
EIA	Environmental Impact Assessment - a term used for the assessment of environmental consequences (positive or negative) of a plan, policy, program or project prior to the decision to move forward with the proposed action.
ES	Environmental Statement – a report in which the process and results of an Environment Impact Assessment are documented.
EU	European Union - an economic and political union of 27 countries.
HGV	Heavy Goods Vehicle - vehicles with a gross weight in excess of 3.5 tonnes.
HRA	Habitats Regulations Assessment – the assessment of the impacts of implementing a plan or policy on a Natura 2000 site required under the Habitats Directive.
INNS	Invasive Non-native Species - species established outside of their natural range and which considered damaging for native biodiversity and/or to economic activities.
IROPI	Imperative Reasons of Overriding Public Interest
km	Kilometre – unit of distance.
kV	Kilovolt – unit of voltage
LSE	Likely Significant Effects
MMO	Marine Management Organisation - an executive, non-departmental body in the United Kingdom with the responsibility of licensing, regulating and planning marine activities in the seas around England so that they are carried out in a sustainable way.
MW	Megawatt – unit of power
NGR	National Grid Reference - system of geographical grid references.
NLC	North Lincolnshire Council – the local planning authority with jurisdiction over the area within which the Keadby Power Station Site and Proposed Development Site are situated

Abbreviation	Description
NPPF	National Planning Policy Framework - The NPPF is part of the Government's reform of the planning system intended to make it less complex, to protect the environment and to promote sustainable growth. It does not contain any specific policies on Nationally Significant Infrastructure Projects, but its policies may be taken into account in decisions on DCOs if the Secretary of State considers them to be both important and relevant.
NSER	No Significant Effects Report – a report describing the findings of the Habitats Regulations Assessment (HRA).
NSIP	Nationally Significant Infrastructure Project - defined by the Planning Act 2008 and cover projects relating to energy (including generating stations, electric lines and pipelines); transport (including trunk roads and motorways, airports, harbour facilities, railways and rail freight interchanges); water (dams and reservoirs, and the transfer of water resources); waste water treatment plants and hazardous waste facilities. These projects are only defined as nationally significant if they satisfy a statutory threshold in terms of their scale or effect.
NSR	Noise Sensitive Receptors - locations or areas where dwelling units or other fixed, developed sites of frequent human use occur which may be sensitive to noise impacts.
PC	Process Contribution - represents the change caused by the Proposed Development.
PEA	Preliminary Ecological Appraisal - an ecological assessment method which evaluates the existing ecological value of a site.
PEC	Predicted Environmental Concentration - PC plus background concentration.
PEI	Preliminary Environmental Information – the information referred to in Part 1 of Schedule 4 of the EIA Regulations that has been reasonably compiled by the applicant and is reasonably required to assess the environmental effects of a development project.
PINS	Planning Inspectorate – executive agency of the Ministry of Housing, Communities and Local Government of the United Kingdom Government.
PV	Photovoltaic - captures the sun's energy and convert it into electricity.
RDF	Refuse Derived Fuel - produced from domestic and business waste, which includes biodegradable material as well as plastics.
SAC	Special Area of Conservation – high quality conservation sites that are protected under the European Union Habitats Directive,

Abbreviation	Description
	due to their contribution to conserving those habitat types that are considered to be most in need of conservation.
SCR	Selective Catalytic Reduction - the removal of nitrogen oxides from the flue gas.
SPA	Special Protection Area – strictly protected sites classified in accordance with Article 4 of the EC Birds Directive. Special Protection Areas are Natura sites which are internationally important sites for the protection of threatened habitats and species.
SUDs	Sustainable Urban Drainage System - a natural approach to managing drainage.
WFD	Water Framework Directive - European Union directive which commits member states to achieve good qualitative and quantitative status of all water bodies.
ZCH	Zero Carbon Humber - a consortium of energy and industrial companies and academic institutions aiming to develop the Humber region into a net-zero carbon cluster by 2040

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EXECUTIVE SUMMARY

- 1 Keadby Generation Limited (the 'Applicant') is seeking development consent for the construction, operation and maintenance of a new low carbon Combined Cycle Gas Turbine (CCGT) Generating Station ('the Proposed Development'). The Proposed Development is a new gas fired electricity generating station of up to 910 megawatts (MW) gross electrical output with state-of-the art carbon capture technology and including cooling water, electrical, gas and utility connections, construction laydown areas and other associated works on land to the west of the existing Keadby 1 and Keadby 2 Power Stations, the latter being currently under construction. The Proposed Development will therefore make a significant contribution toward the UK reaching its Net Zero greenhouse gas emissions target by 2050.
- 2 This Habitats Regulation Assessment (HRA) Screening describes the legislation that underpins the requirement to complete a HRA and describes the methodology applied when making the assessment. The assessment provides a screening of the Likely Significant Effects of the Proposed Development during construction, operation and decommissioning on the following European Sites:
 - Humber Estuary SAC;
 - Humber Estuary SPA;
 - Humber Estuary Ramsar site;
 - Thorne Moor SAC;
 - Hatfield Moor SAC; and
 - Thorne and Hatfield Moors SPA.
- 3 The assessment examines the following potential impact pathways, as relevant to each European Site and each phase of the Proposed Development:
 - direct habitat disturbance;
 - visual and noise/ vibration disturbance of qualifying species features;
 - entrapment of river and sea lamprey;
 - spread of invasive non-native species;
 - emission to the atmosphere;
 - deterioration in water quality; and
 - temporary or permanent impacts on foraging resources for qualifying species features.
- 4 The first stage of the assessment involved an assessment of Likely Significant Effects. Following this initial assessment, no Likely Significant Effects was concluded for all potential impact pathways except emissions to the atmosphere

during operation of the Proposed Development. As this latter pathway could not be screened out it was carried forward for the second stage of assessment, which is Appropriate Assessment. The Appropriate Assessment concluded no adverse effect on the integrity of the European Sites.

- 5 Potential in-combination effects of the Proposed Development with other plans and projects was also assessed and the same conclusion was reached i.e. no adverse effect on the integrity of the European Sites.

1.0 INTRODUCTION

1.1 Overview

- 1.1.1 This Habitats Regulations Assessment (HRA) Screening Report (**Application Document Ref. 5.12**) has been prepared by AECOM on behalf of Keadby Generation Limited (the 'Applicant') which is a wholly owned subsidiary of SSE plc. It forms part of the application (the 'Application') for a Development Consent Order (a 'DCO'), that has been submitted to the Secretary of State (the 'SoS') for Business, Energy and Industrial Strategy, under section 37 of 'The Planning Act 2008' (the '2008 Act').
- 1.1.2 The Applicant is seeking development consent for the construction, operation and maintenance of a new low carbon Combined Cycle Gas Turbine (CCGT) Generating Station ('the Proposed Development') on land at, and in the vicinity of, the existing Keadby Power Station, Trentside, Keadby, Scunthorpe DN17 3EF (the 'Proposed Development Site').
- 1.1.3 The Proposed Development is a new electricity generating station of up to 910 megawatts (MW) gross electrical output, equipped with carbon capture and compression plant and fuelled by natural gas, on land to the west of Keadby 1 Power Station and the (under construction) Keadby 2 Power Station, including connections for cooling water, electrical, gas and utilities, construction laydown areas and other associated development. It is described in **Chapter 4: The Proposed Development of the Environmental Statement (ES)** (ES Volume I - **Application Document Ref. 6.2**).
- 1.1.4 The Proposed Development falls within the definition of a 'Nationally Significant Infrastructure Project' (NSIP) under Section 14(1)(a) and Sections 15(1) and (2) of the 2008 Act, as it is an onshore generating station in England that would have a generating capacity greater than 50MW electrical output (50MWe). As such, a DCO application is required to authorise the Proposed Development in accordance with Section 31 of the 2008 Act.
- 1.1.5 The DCO, if made by the SoS, would be known as 'The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order' ('the Order').

1.2 The Applicant

- 1.2.1 The Applicant, Keadby Generation Limited, is the freehold owner of a large part of the Proposed Development Site and is a wholly owned subsidiary of the FTSE 100-listed SSE plc, one of the UK's largest and broadest-based energy companies, and the country's leading developer of renewable energy generation. Over the last 20 years, SSE plc has invested over £20bn to deliver industry-leading offshore wind, onshore wind, CCGT, energy from waste, biomass, energy networks and gas storage projects. The Applicant owns and operates the adjacent Keadby 1 Power Station and is in the process of constructing Keadby 2 Power Station. SSE operates the Keadby Windfarm which lies to the north and south of the Proposed Development Site and

generates renewable energy from 34 turbines, with a total installed generation capacity of 68MW.

- 1.2.2 SSE has produced a ‘Greenprint’ document (SSE plc, 2020a) that sets out a clear commitment to investment in low carbon power infrastructure, working with government and other stakeholders to create a net zero power system by 2040. This includes investment in flexible sources of electricity generation and storage for times of low renewable output which will complement other renewable generating sources, using low carbon fuels and/ or capturing and storing carbon emissions. SSE is working with leading organisations across the UK to accelerate the development of carbon capture, usage and storage (‘CCUS’) clusters, including Equinor and National Grid Carbon.
- 1.2.3 The design of the Proposed Development demonstrates this commitment. The Proposed Development will be built with a clear route to decarbonisation, being equipped with post-combustion carbon capture technology, consistent with SSE’s commitment to reduce the carbon intensity of electricity generated by 60% by 2030, compared to 2018 levels (SSE plc, 2020b). It is intended that the Proposed Development will connect to infrastructure that will be delivered by the Zero Carbon Humber (ZCH) Partnership¹ and Northern Endurance Partnership (NEP)² for the transport and offshore geological storage of carbon dioxide.

1.3 What is Carbon Capture, Usage and Storage?

- 1.3.1 CCUS is a process that removes carbon dioxide emissions at source, for example emissions from a power station or industrial installation, and then compresses the carbon dioxide so that it can be safely transported to secure underground geological storage sites. It is then injected into layers of solid rock filled with interconnected pores where the carbon dioxide becomes trapped and locked in place, preventing it from being released into the atmosphere. Plate 1 shows what is involved in the process.

¹ <https://www.zerocarbonhumber.co.uk/the-vision/>

² <https://www.zerocarbonhumber.co.uk/news/northern-endurance-partnership/>

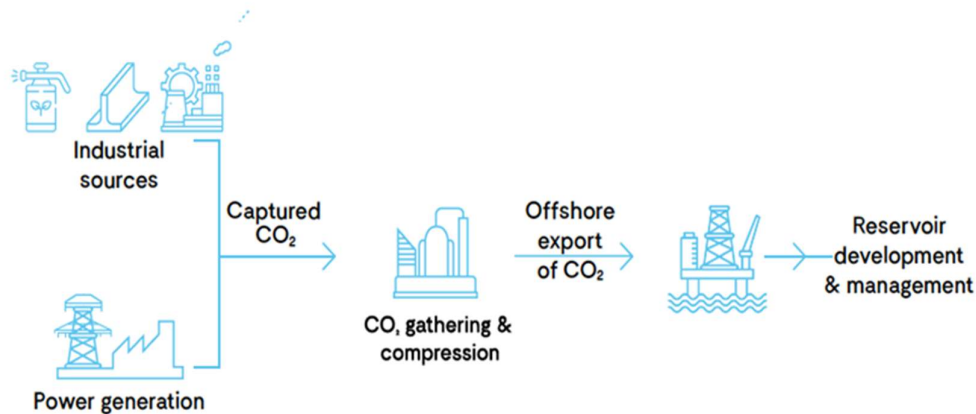


Plate 1: Illustration of the Carbon Capture, Usage and Storage

- 1.3.2 The technologies used in CCUS are proven and have been used safely across the world for many years. Geological storage sites are located far underground and are subject to stringent tests to ensure that they are geologically suitable. It is expected that the storage sites will be located offshore, in areas such as the North Sea. The NEP has been formed to develop the offshore infrastructure to transport and store carbon dioxide emissions in the North Sea.
- 1.3.3 CCUS is crucial to reducing carbon dioxide emissions and combatting global warming. The UK Government has committed to achieving Net Zero in terms of greenhouse gas emissions by 2050. This is a legally binding target. UK Government policy further states that the ‘deployment of power CCUS projects will play a key role in the decarbonisation of the electricity system at low cost’ (HM Government, 2020a, page 47).
- 1.3.4 The Proposed Development will provide up to 910MWe (gross) of dispatchable capacity and capture some 2 million tonnes of carbon dioxide per annum, dependent upon the turbine equipment chosen and the running hours of the plant. The Proposed Development could be up and running by the mid-2020s and will facilitate the timely development of a major CCUS cluster in the Humber region, making an important contribution towards the achievement of Net Zero by 2050.

1.4 The Proposed Development

- 1.4.1 The Proposed Development will work by capturing carbon dioxide emissions from the gas-fired power station and connecting into the ZCH Partnership export pipeline and gathering network for onward transport to the Endurance saline aquifer under the North Sea.
- 1.4.2 The Proposed Development would comprise a low carbon gas fired power station with a gross electrical output capacity of up to 910MWe and associated buildings, structures and plant and other associated development defined in the

Schedule 1 of the draft DCO (**Application Document Ref. 2.1**) as Work No. 1 – 11 and shown on the Works Plans (**Application Document Ref. 4.3**).

1.4.3 At this stage, the final technology selection cannot yet be made as it will be determined by various technical and economic considerations and will be influenced by future UK Government policy and regulation. The design of the Proposed Development therefore incorporates a necessary degree of flexibility to allow for the future selection of the preferred technology in the light of prevailing policy, regulatory and market conditions once a DCO is made.

1.4.4 The Proposed Development will include:

- a carbon capture equipped electricity generating station including a CCGT plant (**Work No. 1A**) with integrated cooling infrastructure (**Work No. 1B**), and carbon dioxide capture plant (CCP) including carbon dioxide absorption unit(s) and stack(s), conditioning and compression equipment (**Work No. 1C**), natural gas receiving facility (**Work No. 1D**), supporting activities including control room, workshops, stores, raw and demineralised water tanks and permanent laydown area (**Work No. 1E**), and associated utilities, various pipework, water treatment plant, wastewater treatment, firefighting equipment, emergency diesel generator, gatehouse, chemical storage facilities, other minor infrastructure and auxiliaries/ services (all located in the area referred to as the 'Proposed Power and Carbon Capture (PCC) Site' and which together form **Work No. 1**);
- natural gas pipeline from the existing National Grid Gas high pressure (HP) gas pipeline within the Proposed Development Site to supply the Proposed PCC Site including an above ground installation (AGI) for National Grid Gas's apparatus (**Work No. 2A**) and the Applicant's apparatus (**Work No. 2B**) (the 'Gas Connection Corridor');
- electrical connection works to and from the existing National Grid 400kV Substation for the export of electricity (**Work No. 3A**) (the 'Electrical Connection Area to National Grid 400kV Substation');
- electrical connection works to and from the existing Northern Powergrid 132kV Substation for the supply of electricity at up to 132kV to the Proposed PCC Site, and associated plant and equipment (**Work No. 3B**) (the 'Potential Electrical Connection to Northern Powergrid 132kV Substation');
- Water Connection Corridors to provide cooling and make-up water including:
 - underground and/ or overground water supply pipeline(s) and intake structures within the Stainforth and Keadby Canal, including temporary cofferdam (**Work No. 4A**) (the 'Canal Water Abstraction Option');
 - in the event that the canal abstraction option is not available, works to the existing Keadby 1 power station cooling water supply pipelines and intake structures within the River Trent, including temporary cofferdam (**Work No. 4B**) (the 'River Water Abstraction Option');

- works to and use of an existing outfall and associated pipework for the discharge of return cooling water and treated wastewater to the River Trent (**Work No. 5**) (the 'Water Discharge Corridor');
- towns water connection pipeline from existing water supply within the Keadby Power Station to provide potable water (**Work No. 6**);
- above ground carbon dioxide compression and export infrastructure comprising an above ground installation (AGI) for the undertaker's apparatus including deoxygenation, dehydration, staged compression facilities, outlet metering, and electrical connection (**Work No. 7A**) and an above ground installation (AGI) for National Grid Carbon's apparatus (**Work No. 7B**);
- new permanent access from A18, comprising the maintenance and improvement of an existing private access road from the junction with the A18 including the western private bridge crossing of the Hatfield Waste Drain (**Work No. 8A**) and installation of a layby and gatehouse (**Work No. 8B**), and an emergency vehicle and pedestrian access road comprising the maintenance and improvement of an existing private track running between the Proposed PCC Site and Chapel Lane, Keadby and including new private bridge (**Work No. 8C**);
- temporary construction and laydown areas including contractor facilities and parking (**Work No. 9A**), and access to these using the existing private roads from the A18 and the existing private bridge crossings, including the replacement of the western existing private bridge crossing known as 'Mabey Bridge' over Hatfield Waste Drain (**Work No. 9B**) and a temporary construction laydown area associated with that bridge replacement (**Work No. 9C**);
- temporary retention, improvement and subsequent removal of an existing Additional Abnormal Indivisible Load Haulage Route (**Work No. 10A**) and temporary use, maintenance, and placement of mobile crane(s) at the existing Railway Wharf jetty for a Waterborne Transport Offloading Area (**Work No. 10B**);
- landscaping and biodiversity enhancement measures (**Work No. 11A**) and security fencing and boundary treatments (**Work No. 11B**); and
- associated development including: surface water drainage systems; pipeline and cable connections between parts of the Proposed Development Site; hard standings and hard landscaping; soft landscaping, including bunds and embankments; external lighting, including lighting columns; gatehouses and weighbridges; closed circuit television cameras and columns and other security measures; site preparation works including clearance, demolition, earthworks, works to protect buildings and land, and utility connections; accesses, roads, roadways and vehicle and cycle parking; pedestrian and cycle routes; and temporary works associated with the maintenance of the authorised development.

1.4.5 The Applicant will be responsible for the construction, operation (including maintenance) and eventual decommissioning of the Proposed Development,

with the exception of the National Grid Gas compound works (**Work No. 2A**), the works within the National Grid Electricity Transmission 400kV substation (part of **Work No. 3A**), the works within the Northern Powergrid 132kV substation (part of **Work No. 3B**), and the National Grid Carbon compound works (**Work No. 7B**), which will be the responsibility of those named beneficiaries.

- 1.4.6 The Proposed Development includes the equipment required for the capture and compression of carbon dioxide emissions from the generating station so that it is capable of being transported off-site. ZCH Partnership will be responsible for the construction, operation and decommissioning of the carbon dioxide gathering network linking onshore power and industrial facilities including the Proposed Development in the Humber Region. The carbon dioxide export pipeline does not, therefore, form part of the Proposed Development and is not included in the Application but will be the subject of separate consent applications by third parties, such as the Humber Low Carbon Pipeline DCO Project by National Grid Carbon³.
- 1.4.7 The Proposed Development will operate 24 hours per day, 7 days per week with programmed offline periods for maintenance. It is anticipated that in the event of CCP maintenance outages, for example, it will be necessary to operate the Proposed Development without carbon capture, with exhaust gases from the CCGT being routed via the Heat Recovery Steam Generator (HRSG) stack.
- 1.4.8 Various types of associated and ancillary development further required in connection with and subsidiary to the above works are detailed in Schedule 1 'Authorised Development' of the draft DCO (**Application Document Ref. 2.1**). This along with **Chapter 4: The Proposed Development in the ES Volume I (Application Document Ref. 6.2)** provides further description of the Proposed Development. The areas within which each numbered Work (component) of the Proposed Development are to be built are defined by the coloured and hatched areas on the Works Plans (**Application Document Ref. 4.3**).

1.5 The Proposed Development Site

- 1.5.1 The Proposed Development Site (the 'Order Limits') is located within and near to the existing Keadby Power Station site near Scunthorpe, Lincolnshire and lies within the administrative boundary of North Lincolnshire Council (NLC). The majority of land is within the ownership or control of the Applicant (or SSE associated companies) and is centred on national grid reference 482351, 411796.

³ <https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/humber-low-carbon-pipelines/>

- 1.5.2 The existing Keadby Power Station site currently encompasses the operational Keadby 1 and (under construction) Keadby 2 Power Station sites, including the Keadby 2 Power Station Carbon Capture and Readiness reserve space.
- 1.5.3 The Proposed Development Site encompasses an area of approximately 69.4 hectares (ha). This includes an area of approximately 18.7ha to the west of Keadby 2 Power Station in which the generating station (CCGT plant, cooling infrastructure and CCP) and gas connection will be developed (the Proposed PCC Site).
- 1.5.4 The Proposed Development Site includes other areas including:
- Previously developed land, along with gas, towns water and other connections, and access routes, within the Keadby Power Station site;
 - the National Grid 400kV Substation located directly adjacent to the Proposed PCC Site, through which electricity generated by the Proposed Development will be exported;
 - Emergency Vehicle Access Road and Potential Electrical Connection to Northern Powergrid Substation, the routes of which utilise an existing farm access track towards Chapel Lane and land within the existing Northern Powergrid substation on Chapel Lane;
 - Water Connection Corridors:
 - Canal Water Abstraction Option which includes land within the existing Keadby Power Station site with an intake adjacent to the Keadby 2 Power Station intake and pumping station and interconnecting pipework;
 - River Water Abstraction Option which includes a corridor that spans Trent Road and encompasses the existing Keadby Power Station pumping station, below ground cooling water pipework, and infrastructure within the River Trent; and
 - a Water Discharge Corridor which includes an existing discharge pipeline and outfall to the River Trent and follows a route of an existing easement for Keadby 1 Power Station;
 - an existing river wharf at Railway Wharf (the Waterborne Transport Offloading Area) and existing temporary haul road into the into the existing Keadby 1 Power Station Site (the 'Additional Abnormal Indivisible Load (AIL) Route');
 - a number of temporary Construction Laydown Areas on previously developed land and adjoining agricultural land; and
 - land at the A18 Junction and an existing site access road, including two existing private bridge crossing of the Hatfield Waste Drain lying west of Piffrey Farm (the western of which is known as Mabey Bridge, to be replaced, and the eastern of which is termed Skew Bridge) and an existing temporary gatehouse, to be replaced in permanent form.

- 1.5.5 In the vicinity of the Proposed Development Site the River Trent is tidal, therefore parts of the Proposed Development Site are within the UK marine area. No harbour works are proposed.
- 1.5.6 Further description of the Proposed Development Site and its surroundings is provided in **Chapter 3: The Site and Surrounding Area** in ES Volume I (**Application Document Ref. 6.2**).

1.6 The Development Consent Process

- 1.6.1 As a NSIP project, the Applicant is required to obtain a DCO to construct, operate and maintain the generating station, under Section 31 of the 2008 Act. Sections 42 to 48 of the 2008 Act govern the consultation that the promoter must carry out before submitting an application for a DCO and Section 37 of the 2008 Act governs the form, content and accompanying documents that are required as part of a DCO application. These requirements are implemented through the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ('APFP Regulations') which state that an application must be accompanied by an ES, where a development is considered to be 'EIA development' under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations).
- 1.6.2 An application for development consent for the Proposed Development has been submitted to the Planning Inspectorate (PINS) acting on behalf of the Secretary of State. Subject to the Application being accepted (which will be decided within a period of 28 days following receipt of the Application), PINS will then examine it and make a recommendation to the Secretary of State, who will then decide whether to make (grant) the DCO.

1.7 The Purpose and Structure of this Document

- 1.7.1 When preparing a DCO application, applicants are required to consider the potential effects of the application on protected habitats designated as European Sites⁴. This report has been prepared to meet this requirement. It has been prepared in accordance with Planning Inspectorate 'Advice Note Ten: Habitats Regulations Assessment for Nationally Significant Infrastructure Projects' (The Planning Inspectorate, 2017).
- 1.7.2 If a NSIP, when taken alone or with existing and known future plans or projects, is likely to affect a European Site, the applicant must provide a report with sufficient information to enable the competent authority (which in this case is the Secretary of State) to make an Appropriate Assessment, if required, under

⁴ European Sites, including European Marine Sites, are taken to encompass the following kinds of nature conservation designation: Special Areas of Conservation (SAC), candidate SAC (cSAC), possible SAC (pSAC), Special Protection Areas (SPA), potential SPA (pSPA) and Ramsar sites.

the terms of Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) (HMSO, 2017) (commonly referred to as the 'Habitats Regulations'). Accordingly, the DCO application must include all such information as may reasonably be required 'for the purposes of the assessment' or 'to enable them to determine whether an Appropriate Assessment is required'. This information is provided in this report.

1.7.3 The document is structured as follows:

- Section 2 describes the legislation underpinning the requirement for this assessment;
- Section 3 describes the methodology applied when making the assessment;
- Section 4 defines the relevant European Sites and their qualifying features of interest;
- Section 5 provides a screening of the Likely Significant Effects of the Proposed Development during construction, operation and decommissioning;
- Section 6 examines in more detail the impact pathways that could not be screened out in Section 5 to provide an Appropriate Assessment;
- Section 7 provides an assessment of the potential in-combination effects of the Proposed Development with other plans and projects;
- Section 8 provides the conclusions of the assessment;
- **Appendix A** provides the HRA screening matrices required by the Planning Inspectorate;
- **Appendix B** summarises the results of the operational air quality assessment in relation to European Sites;
- **Appendix C** provides the HRA integrity matrices required by the Planning Inspectorate; and
- **Appendix D** provides information on the other plans and projects considered by the in-combination assessment.

2.0 LEGISLATIVE CONTEXT

- 2.1.1 The need to undertake HRA is implemented in English and Welsh law by the Habitats Regulations. This, through Regulation 63, transposes into English law the requirements of the Habitats Directive (European Council Directive 92/43/EEC) (European Commission, 1992) and the Birds Directive (European Council Directive 2009/147/EEC) (European Commission, 2009). As a consequence, as part of the assessment of a proposed project, it is necessary to consider whether the project is likely to have a significant effect on the national site network (i.e. European Sites as first defined in Section 1.7 of this report).
- 2.1.2 Over the years, the term HRA has become widely used to describe the overall process set out in the Habitats Regulations (as covered in Advice Note Ten (Planning Inspectorate, 2017)). This has arisen in order to distinguish the overall process from the individual stage of 'Appropriate Assessment'; which is the latter stage and responsibility of the competent authority (the Secretary of State). Throughout this report the term HRA is therefore used for the overall process and use of the term Appropriate Assessment is restricted to the specific stage of that name.
- 2.1.3 One of the aims of the Habitats Regulations is to '*maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of national interest*' (Article 2(2)). This aim therefore relates to habitats and species, not the European Sites themselves, although the European Sites have a role in delivering favourable conservation status. The Habitats Regulations also apply the precautionary principle⁵ to European Sites.
- 2.1.4 The UK left the European Union (EU) on 31 January 2020 under the terms set out in the European Union (Withdrawal Agreement) Act 2020 (UK Government, 2020). Through this Act, the body of existing EU-derived law within UK domestic law is retained. As such this assessment takes account of relevant EU case law.

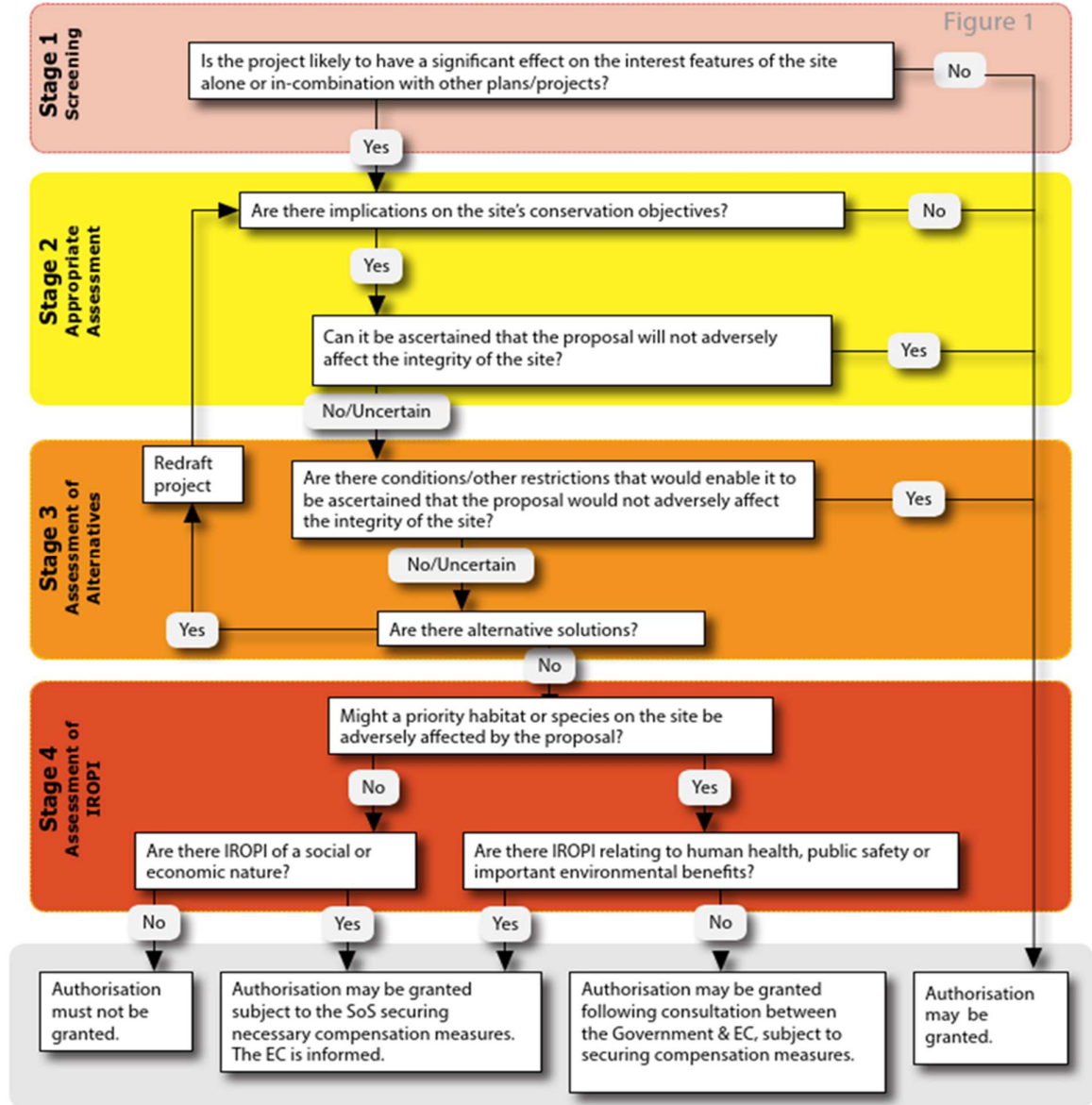
⁵ The Precautionary Principle, which is referenced in Article 191 of the Treaty on the Functioning of the European Union, has been defined by the United Nations Educational, Scientific and Cultural Organisation as: '*When human activities may lead to morally unacceptable harm [to the environment] that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm. The judgement of plausibility should be grounded in scientific analysis.*'

3.0 METHODOLOGY

3.1 Introduction

- 3.1.1 The HRA has been carried out with reference to the general EU guidance on HRA (European Commission, 2001), general guidance on HRA published by the UK government in July 2019 (Ministry of Housing, Communities & Local Government, 2019), and specific guidance issued for NSIP as Advice Note Ten (Planning Inspectorate, 2017).
- 3.1.2 The HRA has also been prepared having regard to relevant case law relating to the Habitats Regulations, the Habitats Directive and the Birds Directive. This includes the ruling by the Court of Justice of the European Union (CJEU) in the case of People Over Wind, Peter Sweetman v Coillte Teoranta (C-323/17). This case held that; *'it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site'* (paragraph 40). This establishes that 'mitigation measures' cannot be considered at the screening stage, but they can be considered in an Appropriate Assessment.
- 3.1.3 Plate 2 below outlines the stages of HRA according to Advice Note Ten.

Plate 2: The Four Stage Approach to Habitats Regulations Assessments of Projects



Source: Planning Inspectorate, 2017: Advice Note Ten

- 3.1.4 As shown in Plate 1, the first stage of HRA involves screening of the Proposed Development (alone and in-combination with other plans and projects) concerned for 'Likely Significant Effects' (LSE) as described in Sections 3 to 6 of this report. At this stage of HRA, options for the mitigation⁶ of LSE cannot be considered.
- 3.1.5 Should it be found that significant effects are likely, an 'Appropriate Assessment' should then be carried out in order to further assess those effects. Under Regulation 63 of the Habitats Regulations it is required that '*A competent authority, before deciding to ... give any consent for a plan or project which is likely to have a significant effect on a European site ... must make an appropriate assessment of the implications for the plan or project in view of that site's conservation objectives... The competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site.*' During Appropriate Assessment consideration can be given to potential mitigation options. Consent may only be given for a proposed scheme if, following appraisal of mitigation measures, it is established that it will not adversely affect the integrity of the European Site.
- 3.1.6 If adverse effects are identified, after accounting for mitigation measures, alternatives should be considered to avoid those effects. However, where no alternative solution exists and an adverse effect remains, a further assessment should be made of whether the scheme is required for imperative reasons of overriding public interest (IROPI). If the scheme meets that IROPI test, compensatory measures will be required in order to maintain the integrity of affected European Sites.
- 3.1.7 This assessment addresses HRA stages 1 and 2 only, as the results of the assessment indicate that there is no need to progress to the next stage of assessment.
- 3.1.8 Whilst the HRA decisions must be taken by the competent authority, the information needed to undertake the necessary assessments must be provided by the Applicant. The summary information needed for the competent authority to establish whether there are any LSE from the Proposed Development is therefore provided in this report. This information has been compiled with reference to **Chapter 4: The Proposed Development**, **Chapter 8: Air Quality**, **Chapter 9: Noise and Vibration**, **Chapter 11: Biodiversity and Nature Conservation**, **Chapter 12: Water Environment and Flood Risk of the ES (ES Volume I - Application Document Ref 6.2)**.

⁶ Mitigation is defined as measures which avoid or reduce an impact, or the effect of an impact, at the location at which it is predicted to occur.

3.2 HRA Stage 1 – Screening for Likely Significant Effects

3.2.1 The objective of the LSE test is to ‘screen out’ those aspects of a project that can, without any detailed appraisal or consideration of mitigation measures, be said to be unlikely to result in significant adverse effects upon European Sites. Usually this is achieved because there is no mechanism (‘pathway’) for an adverse interaction with the relevant European Sites. Any remaining aspects are then taken forward to Appropriate Assessment. The LSE assessment must also consider the potential for effects ‘in-combination’ with other plans and projects.

3.3 HRA Stage 2 – Appropriate Assessment

3.3.1 Where it is determined that a conclusion of ‘no LSE’ cannot be drawn, there is a need to proceed to the next stage of HRA known as Appropriate Assessment. Case law has clarified that Appropriate Assessment is not a technical term. In other words, there are no specific technical analyses, or level of detail, that are classified by law as belonging to Appropriate Assessment rather than the screening for LSE. The Appropriate Assessment constitutes whatever level of further assessment is required to determine whether an adverse effect on integrity would arise.

3.3.2 By virtue of the fact that it follows the screening process, there is an implication that the analysis will be more detailed than undertaken at the previous stage. One of the key considerations during Appropriate Assessment is whether there is available mitigation that would entirely address the potential effect, allowing for a conclusion of no adverse effect on integrity of a European Site. In practice, the Appropriate Assessment takes any element of the Proposed Development that could not be dismissed following HRA Stage 1 and assesses the potential for an effect in more detail, with a view to concluding whether there would be an adverse effect on site integrity (i.e. disruption of the coherent structure and function of the European Site(s) and the ability of the site to achieve its conservation objectives).

3.4 The Rochdale Envelope

3.4.1 Within Advice Note Nine: Rochdale Envelope (Planning Inspectorate, 2018), the Planning Inspectorate explains how the principles of the Rochdale Envelope should be used within the EIA process.

3.4.2 The Rochdale Envelope is applicable where some of the details of a Proposed Development cannot be confirmed when an application is submitted, and flexibility is needed to address uncertainty. Notwithstanding, all significant potential effects of a Proposed Development must be adequately addressed.

3.4.3 It encompasses three key principles:

- the assessment should use a cautious worst-case approach;

- the level of information assessed should be sufficient to enable the LSE of a Proposed Development to be assessed; and
- the allowance for flexibility should not be abused to provide inadequate descriptions of projects.

3.4.4 This HRA has given due consideration to the Rochdale Envelope in the screening process for LSE. The worst-case (i.e. the potentially most impactful) construction, operational and decommissioning scenarios identified within the relevant EIA chapters (ES Volume I - **Application Document Ref. 6.2**) have been assessed in relation to impact pathways.

3.5 Interaction with Other Competent Authorities

3.5.1 PINS Advice Note Ten (Planning Inspectorate, 2017) requires an evaluation of the potential for the Proposed Development to require other consents which could also require HRA by different competent authorities, and a statement as to whether the Order Limits for the Application overlaps with devolved administrations or other European States.

3.5.2 The relevant competent authority in this instance is the Secretary of State as Examining Authority. It is confirmed that the Order Limits for the Proposed Development does not overlap with areas of devolved administrations, nor with those of other European States.

3.6 Consultation with Natural England and/ or General Public

3.6.1 Regulation 63(3) and (4) of the Habitats Regulations refer to the need for, and option of, consultation with Natural England and the public respectively.

3.6.2 At both EIA Scoping stage and Stage 2 statutory consultation on the Preliminary Environmental Information (PEI) report (AECOM, November 2020), Natural England was consulted on the proposed scope of the ecological impact assessment (EclA) and the preliminary findings of the EclA. Their responses to both scoping and formal consultation stages of the ES and a summary of the comments received from Natural England in respect of the potential for adverse effects on European Sites is provided in **Table 11.3** of **Chapter 11: Biodiversity and Nature Conservation** (ES Volume I - **Application Document Ref. 6.2**).

3.6.3 Engagement has continued leading up to submission of the Application, to provide copies of final draft documents and offer a pre-application meeting (which took place on 15 January 2021) to:

- discuss final proposals and assessments;
- obtain feedback prior to submission of Application; and
- agree an approach to drafting of Statements of Common Ground (SoCG) prior to submission of the Application

- 3.6.4 Other consultees, including the Environment Agency, Marine Management Organisation (MMO), North Lincolnshire Council, and Lincolnshire Wildlife Trust, either deferred to Natural England’s judgement regarding HRA, will await the results of the HRA once the application is submitted, or made no specific comment on HRA in their responses to statutory consultation (see **Table 11.3** within **Chapter 11: Biodiversity and Nature Conservation** (ES Volume I - **Application Document Ref. 6.2**)).
- 3.6.5 The public have been able to take part and provide their views of the Proposed Development through the Applicant’s pre-application consultation processes. Information on responses is set out in the Consultation Report (**Application Document Ref 5.1**).

4.0 BASELINE EVIDENCE GATHERING

4.1 Scope of the Project

4.1.1 There is no guidance that dictates the scope of an HRA. Therefore, in considering the scope of the assessment, guidance was primarily provided by the identified impact pathways (called the 'source-pathway-receptor model').

4.1.2 Briefly defined, impact pathways are routes by which the implementation of a project can lead to an effect upon a European Site. An example of this would be visual and noise disturbance arising from the construction work or operational phase of a project. If there are sensitive ecological receptors within a nearby European Site (e.g. non-breeding overwintering birds), this could alter their foraging and roosting behaviour and potentially affect the integrity of the European Site. For some impact pathways (notably air pollution) there is guidance that sets out distance-based zones required for assessment. For others, a professional judgment must be made based on the best available evidence.

4.2 Relevant European Sites

4.2.1 Guidance published by the Environment Agency (Department for Environment, Food & Rural Affairs and Environment Agency, 2016) recommends that for large power generation developments greater than 50MW, a radius of search of 15km should be used when identifying relevant European Sites which may be affected by operational emissions to air. This is the approach adopted as originally identified in the Scoping Report (**Appendix 1A**, ES Volume II - **Application Document Ref 6.3**) and subsequently re-confirmed in the PEI Report (AECOM, 2020) for the Proposed Development.

4.2.2 The following European Sites were identified within a 15km radius of the Proposed Development:

- Humber Estuary Special Area of Conservation (SAC), which overlaps with the construction footprint for the Proposed Development and at its closest point is 1.3km east from the proposed location for the Proposed PCC Site;
- Humber Estuary Special Protection Area (SPA), which is located 9.2km north-east of the closest proposed construction activities and 9.8km north-east of the Proposed PCC Site;
- Humber Estuary Ramsar site, which is located as per the Humber Estuary SAC;
- Thorne Moor SAC, which is located 5.5km north-west of the closest proposed construction activities and 6.3km south-west of the Proposed PCC Site;
- Hatfield Moor SAC, which is located 8.2km south-west of the closest proposed construction activities and 10.4km north-west of the Proposed PCC Site; and

- Thorne and Hatfield Moors SPA, which at its closest point (Thorne Moor) is located 5.5km north-west of the closest proposed construction activities and 6.3km south-west of the Proposed PCC Site.

4.2.3 Therefore, these are the European Sites covered by the air quality impact assessment and discussed in Sections 5 and 6 of this report. Although Ramsar sites are not part of the formal network of European Sites, paragraph 176 of the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, 2019) in England extends Ramsar sites the same level of protection as European Sites.

4.2.4 In addition to air quality, there are several other impact pathways such as construction and operational disturbance, temporary habitat disturbance and modification and water quality impacts that could arise from the Proposed Development. All relevant pathways are considered in this assessment.

4.2.5 Given the design and location of the Proposed Development, there are no likely impact pathways on European Sites located at greater than 15km from the Proposed Development. Therefore, the search radius applied to identify European Sites of relevance to the air quality impact assessment is considered worst-case and sufficiently precautionary for the requirements of the wider HRA of the Proposed Development.

4.2.6 An introduction to and a summary of the qualifying features, conservation objectives and threats/ pressures to the site integrity of the relevant European Sites, is provided in the following section. The location of these sites in relation to the Proposed Development is illustrated in **Figure 2**.

4.3 Humber Estuary SAC, SPA and Ramsar Site

Introduction

4.3.1 The Humber Estuary SAC/ Ramsar Site, the boundaries of which are almost contiguous, is a 36,657.15ha estuarine and coastal site located on the eastern coast of England (JNCC, 2015a; Natural England, 2019a). The boundaries of these sites overlap with the Proposed Development Site at the River Trent at Keadby.

4.3.2 The Humber Estuary SPA has a boundary that diverges more markedly from the above sites. As the boundary of the SPA excludes the River Trent it is not closely associated with the Proposed Development. The SPA applies to 37,630.24ha of estuarine and coastal habitat (JNCC, 2015b, Natural England, 2007).

4.3.3 The Humber Estuary is a large estuary with a high tidal range (macro-tidal). The high suspended sediment loads in the estuary feed a dynamic and rapidly changing system of accreting and eroding intertidal and sub-tidal mudflats and sandflats as well as saltmarsh and reedbeds. Other notable habitats include a range of sand dune types in the outer estuary, together with sub-tidal sandbanks and coastal lagoons. A number of developing managed realignment sites on the

estuary also contribute to the wide variety of estuarine and wetland habitats. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion. As salinity declines upstream, tidal reedbeds and brackish saltmarsh communities fringe the estuary.

4.3.4 Significant fish species include river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) which migrate through the estuary to breed in the upper reaches of the rivers of the Humber catchment. Grey seals (*Halichoerus grypus*) come ashore in autumn to form large breeding colonies on the sandy shores of the south bank around Donna Nook, near Grimsby on the North Sea coastline. Natterjack toad (*Epidalea calamita*) is also relevant in the context of the Ramsar site and is present only on the North Sea coast between Saltfleetby-Theddlethorpe at the southern extremity of the Ramsar site.

4.3.5 The estuary is used by many species of wintering and passage waterbirds attracted by the different habitats of the SPA. For example, the sandy sediments of the outer estuary typically attract knot (*Calidris canutus*) and grey plover (*Pluvialis squatarola*), while waterfowl prefer the wetland zones of the upper estuary. At high tide, large mixed flocks congregate in key roost sites which are at a premium due to the combined effects of extensive land claim, coastal squeeze and lack of grazing marsh and grassland on both banks of the estuary. In summer, the SPA site supports important breeding populations of bittern (*Botaurus stellaris*), marsh harrier (*Circus aeruginosus*), avocet (*Recurvirostra avosetta*) and little tern (*Sternula albifrons*).

[SAC Qualifying Features \(Natural England, 2018a\)](#)

4.3.6 The site qualifies as a SAC under Article 4.4 of the Habitats Directive (Council Directive 92/43/EEC) (European Commission, 1992) by supporting the following Annex I habitats and Annex II species, as per the conservation objectives for the SAC updated in November 2018:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- coastal lagoons;
- dunes with *Hippophae rhamnoides*;
- embryonic shifting dunes;
- estuaries;
- fixed coastal dunes with herbaceous vegetation ("grey dunes");
- mudflats and sandflats not covered by seawater at low tide;
- *Salicornia* and other annuals colonizing mud and sand;
- sandbanks which are slightly covered by sea water all the time;
- shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes");
- sea lamprey;

- river lamprey; and
- grey seal.

SPA Qualifying Features (Natural England, 2019b)

4.3.7 The site qualifies as a SPA under Article 4.1 of the Birds Directive (79/409/EEC) by supporting populations of the following features, as per the conservation objectives for the SPA updated in February 2019:

- *Botaurus stellaris*; Great bittern (Non-breeding);
- *Botaurus stellaris*; Great bittern (Breeding);
- *Tadorna tadorna*; Common shelduck (Non-breeding);
- *Circus aeruginosus*; Eurasian marsh harrier (Breeding);
- *Circus cyaneus*; Hen harrier (Non-breeding);
- *Recurvirostra avosetta*; Pied avocet (Non-breeding);
- *Recurvirostra avosetta*; Pied avocet (Breeding);
- *Pluvialis apricaria*; European golden plover (Non-breeding);
- *Calidris canutus*; Red knot (Non-breeding);
- *Calidris alpina alpina*; Dunlin (Non-breeding);
- *Philomachus pugnax*; Ruff (Non-breeding);
- *Limosa limosa islandica*; Black-tailed godwit (Non-breeding);
- *Limosa lapponica*; Bar-tailed godwit (Non-breeding);
- *Tringa totanus*; Common redshank (Non-breeding);
- *Sterna albifrons*; Little tern (Breeding); and
- waterbird assemblage.

Ramsar Qualifying Features (JNCC, 2007)

4.3.8 The site qualifies as a Ramsar for the following Ramsar criteria:

- **Criterion 1** - The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/ saline lagoons;
- **Criterion 3** - The Humber Estuary Ramsar site supports a breeding colony of grey seals at Donna Nook, the second largest grey seal colony in England. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad;

- **Criterion 5** – The site supports an assemblage of international importance. This is an assemblage of 153,934 waterfowl during the non-breeding season (5-year peak mean 1996/97-2000/2001);
- **Criterion 6** – The site species/ populations occur at levels of international importance. These being:
 - common shelduck, 4,464 individuals, wintering, representing an average of 1.5% of the Great Britain wintering population (5-year peak mean 1996/7-2000/1);
 - Eurasian golden plover, 30,709 individuals, wintering, representing an average of 3.3% of the population (5-year peak mean 1996/7-2000/1);
 - red knot, 28,165 individuals, wintering, representing an average of 6.3% of the population (5-year peak mean 1996/7-2000/1);
 - dunlin, 22,222 individuals, wintering, representing an average of 1.7% of the population (5-year peak mean 1996/7-2000/1);
 - black-tailed godwit, 1,113 individuals, wintering, representing an average of 3.2% of the population (5-year peak mean 1996/7-2000/1);
 - bar-tailed godwit, 2,752 individuals, wintering, representing an average of 2.3% of the population (5-year peak mean 1996/7-2000/1); and
 - common redshank, 4,632 individuals, wintering, representing an average of 3.6% of the population (5-year peak mean 1996/7-2000/1).
- **Criterion 8** - The Humber Estuary acts as an important migration route for both river lamprey and sea lamprey between coastal waters and their spawning areas.

[Conservation Objectives \(Natural England, 2018a and 2019b\)](#)

4.3.9 With regard to the Humber Estuary SAC natural habitats and/ or species for which the site has been designated (the ‘Qualifying Features’) and subject to natural change (Natural England, 2018a), the conservation objectives are 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 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 habitats of qualifying species rely;*
- *the populations of qualifying species; and*

- *the distribution of qualifying species within the site.'*

4.3.10 With regard to the Humber Estuary SPA and the individual species and/ or assemblage of species for which the site has been classified (the 'Qualifying Features'), and subject to natural change (Natural England, 2019b), the conservation objectives are to '*ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:*

- *the extent and distribution of the habitats of the qualifying features;*
- *the structure and function of the habitats of the qualifying features;*
- *the supporting processes on which the habitats of the qualifying features rely;*
- *the population of each of the qualifying features; and*
- *the distribution of the qualifying features within the site.'*

Threats/ Pressures to Site Integrity (Natural England, 2015)

4.3.11 The following threats/ pressures to the site integrity of the Humber Estuary SAC and SPA have been identified in Natural England's Site Improvement Plan (Natural England, 2015):

- water pollution;
- coastal squeeze;
- changes in species distributions;
- under-grazing;
- invasive species;
- natural changes to site conditions;
- public access/ disturbance;
- fisheries: fish stocking;
- fisheries: commercial marine and estuarine;
- direct land-take from development;
- air pollution: impact of atmospheric nitrogen deposition;
- shooting/ scaring;
- direct impact from third party; and
- inappropriate scrub control.

4.4 Thorne Moor SAC, Hatfield Moor SAC and Thorne and Hatfield Moors SPA

Introduction

4.4.1 The Thorne Moor and Hatfield Moors SAC, which both contain habitats designated as Thorne and Hatfield Moors SPA, together comprise 30,280.91ha of degraded raised bog with associated standing water, fen, heathland and woodland habitats and are located in South Yorkshire between Doncaster and Scunthorpe (JNCC, 2015c and 2015d). The boundaries of these sites do not overlap with the Proposed Development Site, and instead at the closest point are located 5.5km from the Proposed Development Site.

SAC Qualifying Features (Natural England, 2018b and 2018c)

4.4.2 Thorne Moor and Hatfield Moor both qualify as SAC under Article 4.4 of the Habitats Directive (Council Directive 92/43/EEC) (European Commission, 1992) as they both support 'degraded raised bogs still capable of natural regeneration' Annex I habitat, as per the conservation objectives set for each of the SAC and updated in November 2018.

SPA Qualifying Features (Natural England, 2019c)

4.4.3 The Thorne and Hatfield Moors SPA qualifies under Article 4.1 of the Birds Directive (79/409/EEC) by supporting populations of European nightjar (*Caprimulgus europaeus*) (Breeding), as per the conservation objectives for the SPA updated in February 2019.

Conservation Objectives (Natural England, 2018b, 2018c and 2019c)

4.4.4 With regard to natural habitats and/ or species for which both the Thorne Moor SAC and the Hatfield Moor SAC have been designated (the 'Qualifying Features'), and subject to natural change (Natural England, 2018b and 2018c), the conservation objectives are identical between the two sites and are 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 of its Qualifying Features, by maintaining or restoring:*

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

4.4.5 With regard to the Thorne and Hatfield Moors SPA, individual species and/ or assemblage of species for which the site has been classified (the 'Qualifying Features'), and subject to natural change (Natural England, 2019c), the conservation objectives are to *'ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:*

- *the extent and distribution of the habitats of the qualifying features;*
- *the structure and function of the habitats of the qualifying features;*
- *the supporting processes on which the habitats of the qualifying features rely;*
- *the population of each of the qualifying features; and*
- *the distribution of the qualifying features within the site.'*

Threats/ Pressures to Site Integrity (Natural England, 2014)

4.4.6 The following list of threats/ pressures to the site integrity of the Thorne Moor SAC, Hatfield Moor SAC and Thorne and Hatfield Moors SPA have been identified in Natural England's combined Site Improvement Plan (Natural England, 2014):

- drainage;
- inappropriate scrub control;
- air pollution: impact of atmospheric nitrogen deposition;
- public access/ disturbance;
- planning permission: general;
- peat extraction; and
- invasive species.

5.0 TEST OF LIKELY SIGNIFICANT EFFECTS

5.1 Overview

- 5.1.1 This section examines the LSE of the Proposed Development. It is structured by development phase, first by construction period and then by the operation and decommissioning periods.
- 5.1.2 Given the timeline for future decommissioning, which would not take place until circa 25 years following commencement of operations, the parameters for assessment of this are less certain. Given this, the construction phase is considered a reasonable and suitably precautionary proxy for potential impacts during decommissioning. This is because requirements at decommissioning (demolition and removal of infrastructure installed at construction) will be comparable to or of lesser scale and magnitude than those at construction. It is also assumed that comparable permitting and regulatory regimes will control the potential impact of decommissioning on the natural environment, in the same way that they do during construction and operation.
- 5.1.3 **Chapter 5: Construction Programme and Management (ES Volume I - Application Document Ref. 6.2)** identifies that the Proposed Development will not involve any demolition. This development phase is therefore not discussed and is excluded from the screening matrices.
- 5.1.4 The European Sites included within this screening assessment, as first identified and described above in Sections 4.3 and 4.4 of this report, are:
- Humber Estuary SAC;
 - Humber Estuary SPA;
 - Humber Estuary Ramsar site;
 - Thorne Moor SAC;
 - Hatfield Moor SAC; and
 - Thorne and Hatfield Moor SPA.
- 5.1.5 The potential pathways for impact on these European Sites are drawn from those summarised in **Appendix A** of this report, which provides the completed 'Appendix 1 Screening Matrix' template required to comply with Advice Note Ten (Planning Inspectorate, 2017).
- 5.1.6 Each of the potential impact pathways identified in **Appendix A** (e.g. noise and visual disturbance, air quality etc.) is discussed separately for each development phase (construction and/ or operation) to which that impact pathway applies. A summary statement is also provided for decommissioning.

5.2 Construction Period

Habitat Disturbance and Modification

- 5.2.1 The Proposed Development does not require any new land-take from European Sites. However, in the event that the preferred cooling water abstraction from the Stainforth and Keadby Canal is not available (Work No. 4A in **Application Document Ref. 4.3**), localised and temporary in-channel and bank works may be required on the River Trent within the Humber Estuary SAC and Ramsar site. In these circumstances there would be a need to upgrade the existing River Water Abstraction (Work No. 4B on **Application Document Ref. 4.3**) for the purposes of installation (if relevant) of an eel screen. The maximum worst-case working areas for these upgrade activities, if required, is 0.13ha. A cofferdam would be required to establish a safe working area during the upgrade works and the indicative extent of this is illustrated in **Figure 12C.10** of **Appendix 12C: Navigational Risk Assessment** (ES Volume II – **Application Document Ref. 6.3**).
- 5.2.2 The Applicant is proposing to re-use existing assets and pipework for Keadby 1 Power Station for the discharge of treated effluent to the River Trent. A Water Discharge Corridor is included in the Proposed Development Site comprising the easement of the existing cooling water corridor north-east from Keadby 1 Power Station, connecting with the River Trent. Interconnecting pipework would extend from Proposed PCC Site to connect to this infrastructure. As part of refurbishment and/ or replacement works within the Water Discharge Corridor, various ancillary works may be required although works are not envisaged at the outfall structure (Work No. 5 - **Application Document Ref. 4.3**).
- 5.2.3 At the location of the existing river water abstraction structures (as described in **Appendix 11C: Preliminary Ecological Appraisal Report** of ES Volume II - **Application Document Ref. 6.3**) the River Trent is a large (approximately 150m wide) tidal watercourse. An engineered flood embankment is present along the eastern bank of the river, protecting the village of Keadby, which supports species-poor improved grassland and is regularly mown. At the time of the surveys for the Proposed Development (April and July 2020) the water within the River Trent was highly turbid due to suspended sediment, as would be expected for a tidal river reach. No aquatic higher plant species were observed within the channel of the river, with the exception of a few fronds of greater duckweed (*Spirodela polyrhiza*). No other in-channel higher plant species would reasonably be expected given this is a tidal reach of a very large river.
- 5.2.4 Along the margins of the River Trent (both banks), above the typical high tide water level, there are narrow strips of transitional vegetation dominated by common reed (*Phragmites australis*) with abundant to occasional hemlock water-dropwort (*Oenanthe crocata*), hedge bindweed (*Calystegia sepium* subsp. *sepium*), wild angelica (*Angelica sylvestris*), great willowherb (*Epilobium hirsutum*), reed canary-grass (*Phalaris arundinacea*) and cleavers (*Galium*

aparine). At the base of this marginal vegetation but above the water line, the only plant species observed were New Zealand pigmyweed (*Crassula helmsii*) and creeping buttercup (*Ranunculus repens*). Below this zone is bare mud at low tide. This relatively species-poor vegetation is not considered an example of transitional saltmarsh, as it is not present in association with any other saltmarsh communities or typical saltmarsh flora. Therefore, the relevant habitat interest features for which the Humber Estuary SAC and Ramsar site is designated at the locations of the proposed construction works are:

- estuaries – encompassing the main river channel; and
- mudflats and sandflats not covered by seawater at low tide – encompassing the marginal mud banks exposed at low tide.

5.2.5 As explained in **Chapter 12: Water Environment and Flood Risk (ES Volume I – Application Document Ref. 6.2)**, while a cofferdam may be used to create and maintain a temporary dry in-channel working areas, it will also be designed to minimise changes in riverbed and bank erosion and toe scour over the duration of its temporary use. On that basis, there is no likely potential for adjacent and downstream habitats to be adversely affected (e.g. by erosion or smothering) through the use of a cofferdam.

5.2.6 Even if sediment was generated during installation of a cofferdam, it is considered that this would not be ecologically damaging for the habitats present in the context of a highly turbid estuarine environment. Previous Water Framework Directive (WFD) assessments (e.g. AECOM, 2015) of dredging operations at the same locations concluded no likely significant adverse effects on water quality or water biodiversity. The MMO has also previously been involved in licensing for the Keadby 1 Power Station Intake & Outfall Dredging (MLA/2017/00312, covering a maximum volume of 25,000m³) and concluded that disturbance to bed sediments is not likely to impact water quality or biodiversity within the estuary. Natural England was also consulted on this licence and advised *'it can be excluded that the application will have a significant effect on any SAC, SPA or Ramsar site, either individually or in-combination with other plans or projects.'* The proposed worst-case construction works are of broadly comparable extent and scale to these previous works and therefore the findings of these previous assessments remain valid for the Proposed Development. It is therefore considered that sediment generation, if this was to occur, would not adversely affect the extent or structure and function of in-channel habitats or the integrity of the Humber Estuary SAC and Ramsar site.

5.2.7 Whilst in use, any cofferdam will temporarily reduce the extent and quality of intertidal mudflat habitats in the immediate vicinity of the cofferdam through removal and/ or drying of sediments in the dewatered area. However, the area of habitat affected is considered trivial (*'de minimis'*) in the context of the size of the Humber Estuary and the extent of comparable intertidal mudflat habitats (worst-case estimate of 0.13ha (<0.01%) in the Proposed Development Site, compared to 9,384ha of mudflat habitat stated on the citation for the Humber Estuary SAC). In addition, any such small-scale loss of mudflat habitat would

be temporary as natural tidal processes will rapidly reintroduce sediments and reinstate mudflats once any cofferdam is removed on the completion of works. No adverse temporary or permanent ecological effects, in terms of extent and structure and function of habitats, are therefore likely. The affected area of marginal mudflat/ estuary habitat would be expected to recover rapidly (within 2 - 5 years from point of impact (Elliott *et al.* 1998; Natural England, 2020)) from temporary disturbance through recharge with sediments naturally present in this highly turbid river reach once water levels are restored, and also through natural tidal scour and movement of sediments.

- 5.2.8 Given the scale, location and type of construction activities (including if use of a cofferdam is required), any associated temporary and very minor habitat disturbances will not result in LSE at the Humber Estuary SAC and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment.

Visual and Noise/ Vibration Disturbance

- 5.2.9 The designated interest features of relevance, in the sequence that they are assessed below, are:
- bird species for which the Humber Estuary SPA and Ramsar site are designated; and
 - lamprey species for which the Humber Estuary SAC and Ramsar site are designated.
- 5.2.10 The Natural England Site Improvement Plan for the Humber Estuary SPA highlights that this site and its qualifying bird species are potentially sensitive to public access and disturbance, primarily as a result of recreational use (Natural England, 2014 and 2015). The Humber Estuary SPA is located more than 9km from the closest potential construction works for the Proposed Development. No effects on SPA bird species utilising habitats within and in proximity to the SPA are likely as a result of construction of the Proposed Development given this distance.
- 5.2.11 There is a requirement to consider visual and airborne noise disturbance on birds in relation to the Humber Estuary Ramsar site, as the boundary coincides with the location of the Proposed Development at the locations of the Waterborne Transport Offloading Area (**Work 10b on Application Document Ref. 4.3**), the River Water Abstraction Option (**Work No. 4B on Application Document Ref. 4.3**) and the Cooling Water Discharge (**Work No. 5A on Application Document Ref. 4.3**). All other construction activities will be undertaken in locations at greater distance from the Ramsar site, to the west of Keadby village. Most construction activities, and the potentially most intrusive activities, will be focussed at the location of the Proposed PCC Site and are therefore located more than 1km from the Ramsar site.

- 5.2.12 Of the potential construction Noise Sensitive Receptors (NSR) modelled for the Proposed Development (**Chapter 9: Noise and Vibration, ES Volume I - Application Document Ref. 6.2**), NSR 4 is located within Keadby village between the Proposed PCC Site and the River Trent. It is therefore the closest NSR to both the main construction activities for the Proposed Development and the river, and consequently provides a sound basis for determining the likely worst-case construction noise levels received at the SAC and Ramsar site from all construction activities with the exception of installation of a cofferdam for the potential River Water Abstraction Option (if required) (which is considered separately below).
- 5.2.13 As confirmed in **Chapter 9: Noise and Vibration, ES Volume I - Application Document Ref. 6.2**) the selection of the Proposed PCC Site and development of the indicative concept layout have already included consideration of potential noise effects and proximity to human and environmental NSR, and include measures such as positioning plant close to the existing Keadby 1 Power Station in order to increase the distance between plant and the NSR (the closest of which are the human NSR at Keadby village). Keadby 1 Power Station is located approximately 450m west of the River Trent and is screened from it by the existing flood embankment and housing along Trent Side Road.
- 5.2.14 The worst-case modelled airborne noise level as a result of construction activities for the Proposed PCC Site (i.e. the main civil engineering works, including piling) at NSR 4 is 45dB which is predicted to occur during weekday daytime construction hours. Based on the observed responses of waterbirds to noise stimuli, an acceptable receptor dose (i.e. regular noise level at the bird) of or below 70dB has been identified by AECOM through discussion with Natural England on schemes in other parts of England. Most recently, Natural England has re-confirmed that this is the adopted threshold for the Humber and Tees Estuaries during consultation on the Net Zero Teesside NSIP in December 2020. This threshold has been derived from research undertaken on the Humber Estuary and subsequently adopted for the Waterbird Disturbance and Mitigation Toolkit (Cutts *et al.* 2013). It is considered to be the threshold below which birds are unlikely to be adversely affected by airborne noise.
- 5.2.15 The main construction activities would therefore not result in noise levels at the Humber Estuary Ramsar site at levels that are likely to be adverse for birds based on established guidance.
- 5.2.16 Moving onto specific consideration of construction activities that might directly affect the River Trent, the need for construction activities including installation of a temporary cofferdam within the River Trent is dependent on the choice of cooling water source. Construction within the river would only be necessary if for any reason the preferred Canal Water Abstraction Option is not possible. If required, the extent of piling activities would be very limited relative to the size of the watercourse, extending into the river channel for up to 22m (focussed on a single intake structure) which is a relatively small distance in the context of a river channel that is circa 150m wide.

- 5.2.17 Noise levels resulting from installation of any cofferdam within the river will not be continuous. Piling works will be restricted to daylight hours/ core construction hours. Thus, piling works will only take place between 07:00 and 19:00. Impact piling (the most disturbing method) is also very short-term and intermittent, as hammering needs to stop periodically to enable checks, bracing and pile ties to be undertaken and there will also be a break in operations between each pile. Any break in impact piling greater than 10 minutes would also trigger a new soft-start procedure allowing a period of lower sound intensity.
- 5.2.18 Modelling of noise levels during installation of a cofferdam, using the methods described in **Chapter 9: Noise and Vibration, ES Volume I - Application Document Ref. 6.2**), has confirmed that the worst-case extent of noise levels above 70dB (the threshold established for a potential impact on birds) is restricted to within approximately 70m from point of origin. This therefore places the zone of influence of piling works for the cofferdam within the existing curtilage of Trentside, Keadby. Consequently, only a very short section of marginal tidally-exposed mudflat habitat (approximately 140m total length) adjacent to Trentside would fall within the zone of influence. The opposite bank of the River Trent would not receive noise levels above 70db given the river is approximately 150m wide at this location. The noise impact is restricted to the related zone of visual disturbance from human activities associated with installation of the cofferdam (see below). It is therefore necessary to consider noise and visual disturbance together in relation to construction of a cofferdam.
- 5.2.19 The Waterbird Disturbance and Mitigation Toolkit (Cutts *et al.* 2013) also sets thresholds for visual disturbance to birds and indicates that the worst-case potential distance within which non-roosting birds could be meaningfully affected (behavioural responses and some species taking flight) by visual disturbance is up to 300m from the disturbance source. At the location of the cofferdam the potential zone of influence of visual disturbance is restricted to the section of the River Trent adjacent to the settlement of Keadby. The River Trent at this location is also a busy navigation used by vessels moving to and from the various ports. This is relevant as the Toolkit also identifies that habituation of birds to human activities can be expected where baseline visual disturbance levels are high. Given this, birds at this location are already likely to be habituated to visual disturbance, and the proposed duration and types of construction activities are broadly consistent with existing sources of visual disturbance. It is therefore unlikely that visual disturbance will meaningfully add to or extend the noise and vibration impact from piling.
- 5.2.20 The above stated, the likelihood and magnitude of disturbance occurring will also depend on whether or not the relevant bird species are likely to be present within the defined zone of influence. The qualifying bird species that are likely to utilise the limited mudflat habitats in the zone of influence are the non-breeding (i.e. over-wintering) waders knot, dunlin, godwit species, ruff and redshank, as well as non-breeding shelduck.
- 5.2.21 The anticipated likely timing for installation of the cofferdam and associated piling works is when water levels within the River Trent are at their lowest i.e.

avoiding winter when the river is likely to be at full flow or in spate for prolonged periods of time. This also ties in with the committed timing of piling to avoid September to November inclusive to avoid affecting migratory salmon (Framework Construction Environmental Management Plan (CEMP) (**Application Document Ref. 7.1**)). Piling works timed for the period May to August inclusive would not coincide with the period of presence for the non-breeding populations of the above species for which the Ramsar site is designated.

- 5.2.22 Consideration also needs to be given to the differences between the boundaries of the Humber Estuary Ramsar site and the Humber Estuary SPA (the latter excluding the River Trent), despite both sites being designated for a comparable waterbird interest. This strongly indicates that the main ornithological interest of the Ramsar site must be associated with habitats located elsewhere, and that the inclusion of the River Trent within the Ramsar site is for other reasons e.g. as one of the main freshwater tributaries sustaining the wider estuary and as habitat for lamprey species (i.e. fish). Given the limited extent of mudflat habitats along the river at low tide, and especially relative to the large resource of such habitats elsewhere in the Ramsar site during low tide, this would appear to be a reasonable inference. As noted above (under habitat disturbance and modification), the mudflat resource available to birds within the zone of influence of construction works represents less than 0.01% of the total resource in the Humber Estuary SAC and Ramsar site.
- 5.2.23 Taking into account existing baseline noise and visual disturbances likely to have resulted in habituation by birds, the limited extent of the predicted impact, the limited suitable habitat available for qualifying bird species in the worst case potential zone of influence, timing restrictions on installation of the cofferdam and the related seasonality of the qualifying bird species, no impacts on the conservation status of any bird species is likely to occur as a result of temporary increases in visual or noise disturbance during construction of a cofferdam and associated upgrade works within the River Trent (if the River Water Abstraction Option is implemented).
- 5.2.24 Moving onto consideration of river and sea lamprey for which the Humber Estuary SAC and Ramsar site are designated, construction of a cofferdam (if required) would result in underwater construction noise and vibration impacts from piling activities and this could potentially have a temporary deterrent effect on the ability of lamprey to access breeding habitats in the wider River Trent catchment as a whole, and to return to the Humber Estuary from these habitats. However, after considering the physiology and ecology of the relevant lamprey species this is not considered likely. This is explained in more detail below. A standalone detailed assessment of potential underwater noise and vibration impacts on fish has also been prepared for the Proposed Development (**Appendix 11H**, ES Volume II – **Application Document 6.3**) and concludes that no fish species (i.e. including fish species of higher sensitivity than lamprey species) would experience an impact to their conservation status as a result of injury from underwater noise and vibration.

- 5.2.25 The impact of underwater noise and vibration on fish ranges from behavioural responses to auditory injury, with the magnitude of impact dependent on the intensity and duration of the sound. In the most extreme cases, such as explosions from the detonation of unexploded ordnance, underwater noise and vibration results in tissue injury or mortality. Sound propagation calculations indicate that physical injury to fish is highly unlikely to occur unless fish are in very close proximity i.e. within 10m of the sound source from impact piling. The basis for this statement is explained in more detail in **Appendix 11H** (ES Volume II – **Application Document 6.3**).
- 5.2.26 Even within this limited potential zone of influence for physical injury, not all fish species are equally sensitive/ vulnerable. In particular, lamprey species are categorised as low hearing sensitivity fish species (Popper *et al.*, 2014) because they lack specialist hearing structures and consequently their ear is relatively simple (they have no swim bladder or anatomical structure tuned to amplify sound signals). Instead, lamprey species are generally considered to be sensitive only to sound particle motion within a narrow band of frequencies (indeed some research indicates that they may only be sensitive to particle motion (Popper & Hawkins, 2019)).
- 5.2.27 Because of this physiology they are inherently resilient to the kinds of physical injury (e.g. barotrauma) that other fish species can experience as result of adverse levels of underwater noise and vibration.
- 5.2.28 For the same reason, it is usually considered that adverse changes in behaviour (e.g. behavioural changes that affect migration) as a result of underwater noise and vibration on lamprey are also not likely to occur. Lampreys would need to be very close to a powerful noise source for a behavioural response to occur (Popper, 2005; Popper and Hastings, 2009). Lenhardt and Sismour (1995) carried out experiments on sea lamprey and detected a startle response to frequencies between 20 and 100Hz. However, the response was considered likely to be more due to vibration than waterborne noise. Startles while swimming were rare, suggesting that direct contact with the vibrating surface was needed to trigger the reaction. As further indirect evidence of this, the river lamprey was included in a study on the effect of a playback system (with emission frequencies between 20 and 600Hz) in reducing estuarine fish intake rates at a power plant cooling water inlet (Maes *et al.* 1999, 2004). No significant reductions in river lamprey catches were observed confirming a lack of behavioural response to the noise deterrent.
- 5.2.29 Regardless of the above conclusions, in order to protect other fish species that are not qualifying features of the Humber Estuary SAC, the Proposed Development will adopt the standard mitigation for protection of marine receptors from the effect of underwater sound (JNCC, 2010), specifically a soft-start for all hammer driven piling activity. Whilst these measures are designed for the protection of marine mammals, they also provide protection for fish. These measures ensure that sound intensity from piling, and any associated particle motion, will increase only gradually before reaching full power. This soft start will allow opportunity for individual lampreys located within the potential

zone of influence for an adverse noise or vibration impact (i.e. within 10m of the noise/ vibration source) opportunity to move away from the construction area before there is potential for an impact to be realised.

5.2.30 So, given the inherent lack of sensitivity of lamprey species and the adopted good practice construction methods it can be stated with confidence that no LSE as a result of underwater noise and vibration.

5.2.31 Considering all of the foregoing, visual and noise disturbance from construction works will not result in LSE at the Humber Estuary SAC, SPA and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment.

Entrapment of Lamprey

5.2.32 River and sea lamprey are anadromous migratory species (i.e. migrate upstream to breed) and live their adult life in the estuarine or marine environment, feeding parasitically on the tissue and blood of other fish. After one to two years, lamprey become sexually mature and begin their upstream migration to reach suitable spawning grounds within stony and well oxygenated riffle habitat (Maitland, 2003).

5.2.33 Young larvae of all lamprey species are known as ammocoetes and when they emerge from their spawning gravels, they drift downstream and spend several years burrowing in silt and feeding (Maitland, 2003). Lamprey ammocoetes and their habitat is located in the headwaters of the catchment and this life stage is therefore not relevant to this assessment as they do not occur in the zone of influence of the Proposed Development. Ammocoetes metamorphosize into a 'transformer' stage (a pre-breeding sub-adult stage) after three to five years, and then migrate downstream to estuaries and coastal regions (Maitland, 2003).

5.2.34 All resident and migratory fish species, including but not restricted to river and sea lamprey, could potentially (if present at the time of installation) be trapped within any cofferdam installed to create a dewatered area during construction upgrade works (if required) at the River Water Abstraction Option on the River Trent.

5.2.35 Should fish, including lamprey, species become trapped within the cofferdam, then they would be at no immediate risk. Instead, the risk would arise during drawdown of water levels to create a dry working area for construction. The cofferdam would need to be installed in a manner that delivers legislative compliance with a deemed marine licence (DML) under Part 4 of the Marine and Coastal Access Act 2009, which is proposed to be secured as part of the Draft DCO (**Application Document Ref. 2.1**). The MMO is responsible for enforcing, post-consent monitoring, varying, suspending, and revoking any deemed marine licence(s) as part of the DCO. It must therefore be assumed that regulatory regimes will be properly applied and enforced by the relevant regulators (Department of Energy and Climate Change, 2011). This together is sufficient to remove this potential pathway for an impact on all fish species. Put

simply, the use of cofferdams is controlled through regulation and conditions of a DML must be met, so there is no likely scenario whereby non-compliant use of a cofferdam could occur to the detriment of fish. Consequently, there is no scenario whereby fish could become trapped and would not be appropriately addressed as part of the standard construction approach.

5.2.36 The committed good practice construction approach to cofferdam installation and dewatering involves:

- use of screening on pump intakes to prevent all fish, including lampreys, being drawn into the pipe/ pump during dewatering; and
- supervision of dewatering by an appropriately experienced fish ecologist so that legally binding fish welfare requirements are met, and to relocate any stranded fish, which would include lampreys, back to the main channel of River Trent as soon as possible after capture.

5.2.37 Existing legal and regulatory regimes are sufficient to remove the potential pathway for impact on lampreys through entrapment. Given this, construction works will not result in LSE at the Humber Estuary SAC and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment.

Invasive Non-Native Species

5.2.38 The Preliminary Ecological Appraisal (PEA) of the Proposed Development (**Appendix 11C**, ES Volume II - **Application Document Ref. 6.3**) identified several invasive non-native plant and animal species present within the River Trent or the Stainforth and Keadby Canal. These include zebra mussel (*Dreissena polymorpha*) and Nuttall's waterweed (*Elodea nuttallii*) in the canal, and New Zealand pigmyweed (*Crassula helmsii*) which is widely scattered along the banks of the River Trent at and immediately downstream of the River Water Abstraction Option and the Cooling Water Discharge, within the boundary of the Humber Estuary SAC and Ramsar site. These species are already well established, and there are no barriers to the dispersal of these species between the canal and the river. Given this, construction works would not interact with these species in a manner that would pose a new threat to the Humber Estuary SAC and Ramsar site, and the Humber Estuary SPA located further downstream. The pathway for spread already exists, is uncontrolled, and these species are present where habitats are suitable for establishment.

5.2.39 The PEA identified no other invasive non-native species (INNS) in association with other waterbodies where construction works would take place. Given this, there are no other INNS that are likely to be transferred to the River Trent where construction vehicles, plant, materials etc. are proposed to be moved and/ or used between different parts of the construction site. Given the known presence of invasive species, and legal obligations in relation to this, the Framework Construction Environmental Management Plan (CEMP) (**Application Document Ref. 7.1**) for the Proposed Development includes general

biosecurity measures to mitigate the risk of these known species being transferred from the construction site into the wider landscape. These committed measures will also be applied so that construction vehicles, plant, materials brought into the construction site from other locations do not serve as vectors for introduction of other INNS to the Proposed Development Site, including the River Trent.

5.2.40 In this context, construction works are not likely to introduce INNS and therefore will not result in LSE at the Humber Estuary SAC and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment.

Atmospheric Pollution

5.2.41 Construction activities have potential to impact European Sites through:

- dust, which may be generated by:
 - earthworks (soil stripping, spoil movement and stockpiling);
 - construction (including on-site concrete batching); and
 - trackout (HGV movements on unpaved roads and offsite mud on the highway).
- emissions of pollutants to air (oxides of nitrogen (NO_x) and nitrogen deposition, although commentary on sulphur dioxide (SO₂) is also provided below) as a result of movements of construction traffic on-site and on the affected road network.

5.2.42 To assess this further in accordance with typical accepted good practice, as described in **Appendix 8A: Air Quality – Construction Phase** (ES Volume II – **Application Document Ref. 6.3**), a qualitative assessment has been made of construction dust, and modelling of construction phase road traffic emissions has been undertaken. The latter modelling was undertaken as detailed in current guidance (Institute of Air Quality Management, 2017), and is a ‘detailed level’ assessment that uses dispersion modelling to predict pollutant concentrations, considering additional variables. The assessment used the Atmospheric Dispersion Modelling System (ADMS) Roads dispersion model (version 4.1.1) to predict road pollutant contributions at identified sensitive receptors.

5.2.43 The only European Sites in the zone of influence of potential dust emissions from construction works (which is considered to be up to 500m from source) are the Humber Estuary SAC and Ramsar site. Dust could affect qualifying habitat features through mechanisms such as smothering and direct toxicity (although the latter is not likely given legal requirements and public health considerations). There are no species features for which construction dust would be a relevant consideration.

5.2.44 The qualifying habitat features within this zone of influence relevant to the assessment of dust are (as explained above in Sections 4.3 and 5.2):

- estuaries – encompassing the main river channel; and
- mudflats and sandflats not covered by seawater at low tide – encompassing the marginal mud banks exposed at low tide.

5.2.45 The relevant habitats are therefore those that are either permanently submerged, or periodically exposed and re-submerged as part of the normal tidal cycle. Any dust deposited in these circumstances would add trivially (*de minimis*) to the existing high sediment load already carried by the estuary. There is no mudflat vegetation present in the study area that could experience dust deposition at low tide, and even if there was, this would be removed at the next tide through water movement and wave action. In this context, dust deposition from construction works will not result in LSE at the Humber Estuary SAC and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment.

5.2.46 The incomplete combustion of fuel in vehicle engines results in the presence of a number of potential pollutants (combustion products), of which the main pollutants of concern for European Sites are SO₂ and NO_x.

5.2.47 Although SO₂ is of theoretical relevance, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of the construction activities for the Proposed Development. This is because the relevant construction activities are of types that are not generally considered likely to produce concentrations of SO₂ high enough to result in LSE. In addition, no areas within the administrative boundaries of the relevant council (North Lincolnshire Council, 2019) are considered to be at risk of exceeding the relevant objectives for SO₂, therefore the risks to the attainment of the relevant air quality objectives in the vicinity of the Proposed Development Site are considered negligible. Emissions of SO₂ from construction traffic therefore do not require further assessment.

5.2.48 NO_x can be toxic at very high concentrations (far above the annual average critical level). Of greater relevance, high levels of NO_x can also increase the total nitrogen deposition to soils, potentially leading to deleterious knock-on effects in resident ecosystems. For example, an increase in the total nitrogen deposition from the atmosphere is widely known to enhance soil fertility and to lead to eutrophication. This often has adverse effects on the community composition and quality of semi-natural, nitrogen-limited terrestrial and aquatic habitats (Wolseley *et al*, 2006; Dijk, 2011). The total nitrogen deposition resulting from a plan or project is therefore often assessed as the overarching parameter of relevance for determining the impact of atmospheric pollution from traffic sources. Indeed, current air quality guidance issued by Highways England (2019) focusses solely on nitrogen deposition in relation to ecological features.

5.2.49 The potential zone of influence of construction traffic movements, as defined and used in **Appendix 8A: Air Quality - Construction Phase** (ES Volume II – **Application Document Ref. 6.3**), is 200m from road links in the study area.

According to Highways England (2019), beyond 200m the contribution of vehicle emissions from the roadside to local pollution levels can be considered insignificant. The only European Sites in the zone of influence of construction traffic movements are the Humber Estuary SAC and Ramsar site, and the relevant habitats are again estuaries and mudflats. The Humber Estuary SPA may also be relevant where certain qualifying bird species also make use of (are functionally dependent on) habitats present in the SAC and Ramsar site.

- 5.2.50 The atmospheric dispersion modelling and predicted impacts on European Sites reported in **Appendix 8A: Air Quality – Construction Phase (ES Volume II – Application Document Ref. 6.3)** uses traffic data (Annual Average Daily Traffic (AADT)), as reported in **Chapter 10: Traffic and Transportation (ES Volume I - Application Document Ref. 6.2)** which anticipates that there would be in the order of 1,020 two-way vehicle movements per day during the peak construction period.
- 5.2.51 Chartered Institute of Ecology and Environmental Management (CIEEM) (2021) states that in the UK, the approach to assessing impacts, particularly at the screening stage of HRA, concentrates on the change in levels arising from a proposed plan or project (either alone or in combination) irrespective of whether critical loads or levels are currently being exceeded at a site. For example, Natural England guidance (2018d) states that a project that will result in an increase of no more than 1% of critical loads or levels (either alone or in combination) can be regarded as insignificant in terms of air quality assessment. It is argued that such an approach can be supported by Advocate General Sharpston's Opinion in Case C-258/11 (Peter Sweetman and Others v An Bord Pleanála, 11 April 2013) where at paragraph 48 she stated *'the requirement for an effect to be 'significant' exists in order to lay down a de minimis threshold. Plans and projects that have no appreciable effect on the site can therefore be excluded. If all plans and projects capable of having any effect whatsoever on the site were to be caught by Article 6(3), activities on or near the site would risk being impossible by reason of legislative overkill'* (European Court of Justice, 2013).
- 5.2.52 The Air Pollution Information System (APIS) forms the major source of information regarding the air quality impact pathway. It specifies a critical NO_x concentration (critical threshold) for the protection of vegetation of 30µgm⁻³. This critical concentration would only be exceeded at one of the 20 locations modelled for the Humber Estuary SAC and Ramsar site, with 46.6µgm⁻³ predicted at 5m from the affected road network. Therefore, the predicted exceedance would affect only a minimal part of the European Sites. While the critical level is predicted to be exceeded this also does not automatically mean there would be an impact within the very limited zone of influence, only that the results of the modelling should be considered further. In this case, the relevant estuary and mudflat habitats within the River Trent at this location do not support vegetation and therefore the critical level set for an impact from NO_x on vegetation has no relevance.

- 5.2.53 Ecological studies have also determined ‘critical loads’ of atmospheric nitrogen deposition (that is nitrogen from NO_x combined with ammonia, the latter not being related to vehicle movements). The APIS website has a Site Relevant Critical Load Function tool which enables the sensitivity of each interest feature of each European Site to be examined. Scrutiny of that tool for the Humber Estuary SAC and Ramsar site identifies that the relevant habitats (see above) are or may be sensitive to nitrogen deposition. A lower critical load of 20N/ha/yr is set for estuary habitats (albeit in relation to upper well-vegetated saltmarsh habitats that are not present in the zone of influence). There is no specified critical load for mudflat habitats, but it is considered reasonable to assume that this is also in the order of 20N/ha/yr which is the advised lower critical load for sparsely vegetated pioneer saltmarsh habitats. None of the more sensitive SAC habitats occur in proximity to the Proposed Development within the study area for the construction air quality impact assessment. Instead, these are to be found around the margins of the main estuary, at distances greater than 9km from the Proposed Development.
- 5.2.54 With the Proposed Development, the worst-case nitrogen dose predicted at these European Sites (as reported in reported in **Appendix 8A: Air Quality – Construction Phase (ES Volume II – Application Document Ref. 6.3)**) would be 21.1N/ha/yr, slightly exceeding the critical load of 20N/ha/yr. However, as with NO_x, this would only be within 5m of the affected road network and therefore remains below the critical load for the relevant habitats. This is the worst-case dose received within 5m of the relevant traffic source, where the relevant estuary and mudflat habitats do not support vegetation. Therefore, the critical load set for an impact from nitrogen on vegetation has no relevance.
- 5.2.55 There is also a need to consider potential impacts on species for which the European Sites are designated.
- 5.2.56 The bird species of the Humber Estuary Humber Estuary SPA and Ramsar site, which may utilise habitats (as defined in APIS) present within the Humber Estuary SAC and Ramsar site within the zone of influence, are no more sensitive than the estuary and mudflat habitats assessed above. Similarly, lamprey species when passing through the Humber Estuary SAC and Ramsar site within the zone of influence will be dependent on, and therefore no more sensitive than, the estuary and mudflat habitats assessed above.
- 5.2.57 In this context, emissions from construction traffic will not result in LSE at the Humber Estuary SAC, SPA and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment.

Water Pollution

- 5.2.58 The potential water pollution risks arising during construction of the Proposed Development are assessed in **Chapter 12: Water Environment (ES Volume I – Application Document Ref. 6.2)** and consider a worst-case zone of influence of 1km but also considering case by case any potential for impacts to propagate

further downstream via the flow of affected watercourses. Based on the assessment in **Chapter 12: Water Environment (ES Volume I – Application Document Ref. 6.2)**, the only European Sites considered to be in the potential zone of influence of water pollution from construction activities are the Humber Estuary SAC and Ramsar site.

- 5.2.59 Under the terms of relevant legislation and regulatory regimes, consents/licences would be required from the Environment Agency and/ or the MMO for temporary construction discharges (i.e. water activity permits), and for certain works affecting main rivers, including the River Trent which is part of the relevant European Sites, as well as any temporary dewatering, abstractions or impoundments and in-channel works related to construction activities (i.e. abstraction, impoundment or transfer licences). It is reasonable to assume that these mandatory regulatory regimes will be properly applied and enforced by the relevant regulators (DECC, 2011). The requirements of regulation and permitting have therefore been material considerations when determining construction requirements and methods, as construction would not be allowed to commence if these requirements cannot be met.
- 5.2.60 During construction, accidental water pollution may occur directly from spillages of polluting substances into waterbodies, or indirectly by being conveyed in runoff from hardstanding, other sealed surfaces or from construction machinery. Fine sediment may also be disturbed in waterbodies directly or also wash off working areas and hard standing (including approach roads) into waterbodies indirectly via existing drainage systems or overland. This sediment may potentially contain contaminants that could be harmful to the aquatic environment. Good construction practice measures to avoid, prevent and reduce adverse effects on the water environment and deal with any accidental release form part of the design and impact avoidance measures in **Chapter 12: Water Environment (ES Volume - Application Document Ref. 6.2)** and are thus committed. The Framework CEMP (**Application Document Ref. 7.1**) provided with the DCO Application also sets out standard best practice measures to minimise the risk of water pollution. The CEMP comprises an integral part of the committed construction approach for the Proposed Development so that regulatory and permitting requirements can be and are met by the Applicant and their appointed contractor(s) who would be required to take measures in the Framework CEMP into account.
- 5.2.61 If a cofferdam is required within the River Trent then, as per good industry practice, this would be suitably designed to minimise changes to the estuary bed and bank erosion and toe scour, and associated impacts on water quality. Similarly, dewatering within any cofferdam areas will only be undertaken following any necessary fish rescue and once any fine sediment has settled out such that it is consistent with the turbidity of the flowing River Trent. The rate and location of the discharge will be controlled and carefully chosen to avoid/minimise erosion of any nearby soft sediments.

- 5.2.62 Comparable measures are committed if a cofferdam is required in the Keadby and Stainforth Canal and therefore would similarly prevent releases of sediment with potential to impact the downstream River Trent.
- 5.2.63 Given the measures specified in the Framework CEMP (**Application Document Ref. 7.1**) none of the other waterbodies associated with the Proposed Development are considered likely to provide pathways for dispersal of construction water pollution, should this arise, to the River Trent. Given this, it is very unlikely that pollution from construction activities would occur and disperse via the network of agricultural field drains associated with the Proposed Development Site to the River Trent.
- 5.2.64 In addition to the above considerations, during the construction phase of the Proposed Development, sewage and 'grey water' will also be produced, primarily by toilets, washrooms and kitchen facilities for construction staff. This will either be discharged directly into the existing local sewerage system serving Keadby 1 Power Station, or it will be captured for transportation via tankers to an off-site authorised treatment works. Therefore, it is concluded that there is no available pathway for organic pollution from sewage effluent to affect the River Trent during the construction period.
- 5.2.65 Given the above, water pollution during construction is not likely so will not result in LSE at the Humber Estuary SAC and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment.

Impacts on Foraging Resources

- 5.2.66 The Humber Estuary SPA and Ramsar site is designated for breeding and overwintering birds that forage on invertebrates or small fish. As noted above in Section 4.2, the SPA is located at distance from the Proposed Development, and while there is potential for bird species from both designations to forage in the vicinity of the Proposed Development the location of the SPA (as a bird-specific designation) would strongly imply that the habitats of greatest importance for birds (as opposed to other qualifying features of the sites) are also located at distance. Therefore, within the zone of influence of the Proposed Development the habitats present are likely to be of only local importance for birds.
- 5.2.67 Adult river lamprey for which the Humber Estuary SAC and Ramsar site is designated will spend one to two years feeding on fish in estuaries before returning to breeding grounds (sea lamprey primarily feeds at sea, and ceases feeding before entering river systems on migration to breeding grounds).
- 5.2.68 Elements of the Proposed Development have the potential to temporarily affect the estuary and mudflat habitats within the River Trent in the area associated with and downstream of the Proposed Development. The installation and operation of any temporary cofferdam will result in dewatering and a temporary and very localised impact on these habitats and associated invertebrate fauna.

Underwater noise and vibration may also result in periodic temporary but highly localised disturbance to fish species, deterring fish activity in areas close to construction activities. Therefore, there is potential for temporary changes to the abundance and spatial distribution of the foraging resources of the qualifying species.

5.2.69 The relevant habitats and their associated invertebrate faunal communities will be directly impacted as a result of any cofferdam construction and dewatering, if required. However, the soft sediments which make up the affected habitats around the Proposed Development are highly resilient to direct physical disturbance. The spatial extent of the construction works would be very small (0.13ha maximum extent if the cofferdam is required in the River Trent) and it is expected that both habitats and their associated species would recover within two to five years. The temporary impact on the affected habitats, while significant within the footprint of the construction works, would not be expected to be meaningful in the context of the wider availability of these habitats in the area. As noted above the affected mudflats represent less than 0.01% of the total extent of mudflats within the Humber Estuary SAC and Ramsar site.

5.2.70 Fish, the foraging resource for some bird species and adult river lamprey, could also be affected by the temporary impact and physical disturbance in habitats affected by the marine construction works. While adult fish are able to move away from stressors and are considered less vulnerable to construction works, less mobile benthic life stages (e.g. eggs and larvae) are unable, or less able, to do so. However, the area affected by the proposed construction works does not present habitat features that would render it a particular focal area for large numbers of fish compared to the wider estuary and is a geographically small part of the overall habitat available to fish and species which feed on fish. Furthermore, re-establishment of fish species presence would also be expected on cessation of works (both during breaks in construction activity and immediately after construction of the cofferdam).

5.2.71 Given the above assessment, no effects on the conservation status of the relevant qualifying species are considered likely.

5.2.72 The temporary effects of construction activities on the foraging resources of qualifying species of the Humber Estuary SAC, SPA and Ramsar site is therefore screened out from Appropriate Assessment as it would not affect the conservation objectives.

5.3 Operation Period

Habitat Disturbance and Modification

5.3.1 The outflow of discharged cooling water into the River Trent could, if not appropriately regulated, cause scour and erosion of intertidal mudflat habitats within the Humber Estuary SAC and Ramsar site. However, this is not likely to occur given existing regulatory and permitting regimes which apply to such discharges. The outfall of cooling water will replace – and not be additive to –

the existing consented discharge from Keadby 1 Power Station regulated by the Environment Agency under Environmental Permit YP3133LL, originally issued in April 2006. This allows a maximum daily discharge of 15m³/sec (average over a 24-hour period). There is no evidence that the existing operational discharge from Keadby 1 Power Station is having an effect on habitats within the River Trent. Examination of the setting of the existing outfall structure during ecological surveys in 2020 found no evidence of erosion other than that consistent with the natural tidal rise and fall of the river. The banks of the river were well vegetated by common reed, and marginal mudflats are apparent downstream of the outfall at low tide.

5.3.2 It is anticipated that the rate of discharge from the Proposed Development will be less than 1m³/sec and be discharged intermittently, in combination with the 0.016m³/sec proposed to be discharged from Keadby 2 Power Station. Consequently, it is considered that the Proposed Development will be operating well within the existing consented parameters of Keadby 1 Power Station (**Chapter 12: Water Environment and Flood Risk – ES Volume I, Application Document Ref. 6.2**).

5.3.3 Habitat disturbance and modification from discharges of cooling water is therefore screened out from Appropriate Assessment as it would not affect the conservation objectives.

Visual and Noise/ Vibration Disturbance

5.3.4 During operation, the only direct interaction of the Proposed Development with European Sites will relate to the discharge of cooling water to the River Trent, which is part of the Humber Estuary SAC and Ramsar site; and potentially abstraction, in the event that the preferred Canal Water Abstraction Option is not available and instead the River Water Abstraction Option is implemented. Operation of this infrastructure would be consistent with the usage of the same cooling water intake and outfall structures for Keadby 1 Power Station and the consented use of the existing outfall structure for the discharge of cooling water from Keadby 2 Power Station. So, the baseline airborne and underwater noise and vibration from operation of this infrastructure would not change.

5.3.5 It is likely that the water intake and outfall structures will need periodic maintenance during the operational life of the Proposed Development. Maintenance needs in relation to the outfall structure also have direct relevance for the routine operation of the consented Keadby 1 and 2 Power Stations. Given this, it is not an issue specifically related to the Proposed Development as periodic maintenance would be needed with or without the Proposed Development. Regardless, the potential for visual disturbance associated with periodic maintenance activities at both structures would otherwise also be directly comparable to, or less than, those assessed under construction.

5.3.6 Accordingly, no adverse noise or visual disturbance from operation and maintenance of existing water intake and outfall structures are considered likely.

- 5.3.7 The wider Proposed Development is also not likely to result in airborne noise levels that could affect these European Sites. The noise assessment (**Chapter 9: Noise and Vibration, ES Volume I – Application Document Ref. 6.2**) estimates a worst-case operational noise level of 38dB at NSR 4 (located within Keadby village between the Proposed PCC Site and the River Trent). As explained in Section 5.2 (construction), this is well below the level of noise (70dB) considered potentially detrimental, based on the approved threshold for assessment of impacts on birds within the Humber Estuary. This threshold will also not be exceeded when the operational noise from the Proposed Development is considered in combination with the anticipated future ambient levels (i.e. existing plus Keadby 2 Power Station).
- 5.3.8 Operational noise is therefore screened out from Appropriate Assessment as it would not affect the conservation objectives of the relevant European Sites.

Invasive Non-Native Species

- 5.3.9 The PEA of the Proposed Development (**Appendix 11C, ES Volume II – Application Document Ref. 6.3**) identified the presence of zebra mussel and Nuttall's waterweed within the Stainforth and Keadby Canal. Should the Canal Water Abstraction Option be implemented, then there is a theoretical pathway for dispersal of propagules of these species to the Humber Estuary SAC and Ramsar site via the cooling water discharge into the River Trent.
- 5.3.10 While acknowledging the theoretical impact pathway for dispersal of INNS, this is not likely given the implications of these species for effective operation of the Proposed Development. Zebra mussel in particular has the potential to settle and proliferate within water supply infrastructure such that without intervention, it would be likely, ultimately, to cause a failure of this infrastructure. Accordingly, screening will be used at the water intake to exclude plant material and animals above 2mm size from the water supply, and approved biocide treatments will be used to control smaller life stages and propagules. As such, the design and operational parameters for the Proposed Development preclude potential for dispersal of viable propagules of INNS to the River Trent.
- 5.3.11 It should also be noted that currently there are no existing barriers for the dispersal of the above species from the canal to the River Trent, as the existing lock structure at the point of junction between these two waterbodies allows for partial mixing of waters and is therefore permeable to INNS.
- 5.3.12 Given the design and operational parameters and other relevant considerations, operation of the Proposed Development is not likely to result in the spread of INNS and therefore will not result in LSE at the Humber Estuary SAC and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is screened out from Appropriate Assessment

Atmospheric Emissions

- 5.3.13 The Proposed Development and in particular, operation of the power and carbon capture infrastructure within the Proposed PCC Site will give rise to atmospheric emissions during the operational phase. The CCGT unit will generate electricity through the combustion of natural gas. The resulting combustion gases will contain NO_x concentrations which need to be minimised to achieve BAT-Achievable Emission Levels (BAT-AEL) and to optimise the carbon dioxide capture efficiency. Selective catalytic reduction (SCR) is therefore proposed to control NO_x levels to the BAT-AEL before entering the carbon capture system. SCR is a secondary abatement technique widely used in the power industry and typically involves either injection of ammonia or urea into flue gas to react with any NO_x present in the presence of a catalyst. This abatement process will in itself lead to an emission of ammonia (NH₃). No sulphur dioxide will be emitted since the Proposed Development will be gas-fired.
- 5.3.14 An initial Atmospheric Impact Assessment (AIA) was undertaken to determine the potential impact of the NO_x and ammonia emissions from the operational power station using detailed atmospheric dispersion modelling, for a study area of 15km from the Proposed PCC Site. Through this process, it was determined that abatement of NO_x and ammonia emissions would be necessary. For the purposes of this HRA, such abatement measures constitute mitigation for specific impacts on European Sites and consequently cannot be considered until HRA stage 2 i.e. Appropriate Assessment.
- 5.3.15 Given the above, stack emissions of NO_x and ammonia from operation of the Proposed PCC Site could result in LSE on all of the relevant European Sites and therefore interfere with the ability of these sites to achieve their conservation objectives. This specific pathway is **screened in** for Appropriate Assessment.
- 5.3.16 The operational phase of the Proposed Development will generate site traffic (primarily staff vehicles and HGV deliveries of consumables to site) entering and exiting the Proposed Development Site off the A18 and accessing via North Pilfrey Bridge. Section 4.5 of **Appendix 10A: Transport Assessment (ES Volume II – Application Document Ref. 6.3)** identifies that the Proposed Development will have approximately 50 full-time staff, with a similar shift pattern to the existing Keadby 1 Power Station i.e. a two-shift system of 07:00 – 19:00 and 19:00 – 07:00. Office staff are anticipated to work a core working day between 09:00 and 17:00. Assuming a conservative car occupancy of one person, this equates to 50 cars driving to the Proposed Development per day and a total of 100 two-way vehicle movements. On this basis, a detailed assessment of the operational phase of the proposed development is not considered necessary as the vehicle numbers generated would be considerably lower than the DMRB screening threshold for a more detailed assessment (e.g. >200 vehicles per day).

5.3.17 It is therefore considered to have a negligible effect on air quality. Pollution from operational vehicle movements is therefore screened out from Appropriate Assessment.

Water Pollution

5.3.18 The Proposed Development requires a supply of cooling water for heat rejection purposes. The preferred cooling method is hybrid cooling of both the CCGT and CCP using water abstracted from the Stainforth and Keadby Canal (Canal Water Abstraction Option), or alternatively the River Trent (River Water Abstraction Option). Used cooling water will be returned, following initial cooling in hybrid cooling towers, to the River Trent and therefore the Humber Estuary SAC and Ramsar site. Cooling water will be discharged via the existing outfall structure that was originally installed to serve Keadby 1 Power Station, and which will also serve Keadby 2 Power Station once that scheme becomes operational.

5.3.19 Discharges would be treated and would be regulated by the Environment Agency through the Environmental Permit required for the operation of the Proposed Development. In setting discharge limits, the Environment Agency will also have regard to the requirements of The Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (UK Government, 2017) which requires that all groundwater and surface waters (rivers, lakes, transitional waters, and coastal waters) achieve 'good ecological status' and 'good chemical status'. Ecological status is defined by the biological condition or health of a watercourse, in combination with water quality and physical conditions that underpin biological conditions. Compliance with the WFD Regulations is therefore consistent with requirements for maintenance of the extent/ distribution, structure/ function and/ or conservation status of European Sites and their qualifying features.

5.3.20 The Proposed Development will not 'in combination' add to the existing baseline Keadby 1 and Proposed Keadby 2 Power Station water discharge volumes temperatures as the Keadby 1 Power Station and the Proposed Development will not discharge cooling water return to the river concurrently. It is anticipated that the volume of discharge from the Proposed Development will be less than 1m³/s and would discharge intermittently, in combination with the 0.016 m³/s proposed to be discharged from Keadby 2 Power Station. As such it is considered that the Proposed Development will be operating well within the parameters of what was determined to be not significant for Keadby 1 Power Station, where the existing permit (EPR/YP3133LL) allows a maximum daily discharge of 15m³/s (average of 24-hour period).

5.3.21 It is considered that there will be negligible impact on temperature status of the River Trent, and the thermal discharge would therefore not represent a barrier to migratory routes for fish. Prior modelling of the greater thermal discharge from Keadby 1 Power station concluded that there would be no impact to the overall status of fish populations as a result of temperature-related mortality or thermal

barriers to migratory fish movements (including consideration of lamprey species). It was also considered that this finding confirmed a previous conclusion reached by the Environment Agency that it is unlikely that thermal discharge of the level assessed would have any significant impact on the migration of river and sea lamprey between the river and the Humber Estuary (APEM, 2011).

5.3.22 Cooling water could, if not adequately treated and monitored prior to discharge, contain potential pollutants, including residual biocides and other blowdown products. However, the discharge of cooling water will be subject to existing pollution control and environmental protection regulation and permitting regimes, which it is reasonable to assume will be properly applied and enforced by the relevant regulators including the Environment Agency. Pollution control regimes are concerned with preventing pollution through the use of best available techniques (BAT) to avoid or limit the releases of substances to the environment from different sources to the lowest reasonably practicable level. It also allows ambient air and water quality to meet standards that guard against impacts to the environment or human health (DECC, 2011). The requirements of regulation and permitting have therefore been material considerations for the design of the Proposed Development, as it would not be allowed to operate if the requirements for BAT, for instance, are not met.

5.3.23 Therefore, cooling water will only be discharged at a rate (velocity) and with a chemical and thermal water quality compliant with the discharge limits set by the Environment Agency within the Environmental Permit. Furthermore, cooling water will need to be monitored prior to discharge in compliance with the conditions of the relevant permit(s). Given these substantial regulatory controls, it is not likely that discharged water will contain pollutants, including biocides, at concentrations which could impact on biological or chemical water quality.

5.3.24 Compliance with the requirements of the permitting regimes is mandatory, and the Proposed Development could not be operated without prior attainment of all necessary permits. Accordingly, it is concluded that impacts on European Sites due to the return of cooling water to the River Trent at the outfall location will not result in LSE and can be screened out of Appropriate Assessment.

Entrapment of Lampreys

5.3.25 The preferred water supply for the Proposed Development is the Keadby and Stainforth Canal. In the event that the preferred Canal Water Abstraction Option is not feasible, an alternative option would be to utilise the existing Keadby 1 Power Station cooling water abstraction infrastructure from the River Trent for the Proposed Development (River Water Abstraction Option). If this latter intake is used, then there is a potential pathway for injury and mortality of migrating lamprey species through impingement (the capture and trapping of organisms on intake screens) and entrainment (the passing of small organisms through screens and the transfer of these into the main cooling water transfer system).

- 5.3.26 In relation to entrainment, it should be noted that compliance with current legislative regimes for European eel (*Anguilla anguilla*) (The Eels (England & Wales) Regulations 2009) (UK Government, 2009) requires screening of water intakes (so called 'eel screens') and typically a maximum screen mesh size of 2mm is required by the regulator (Environment Agency). The design for the Proposed Development assumes this mesh size for legal compliance purposes. Consequently, because the Proposed Development has been designed to protect European eel, entrainment of lamprey species could not occur. This potential impact pathway can therefore be discounted. The minimum likely size of the smallest life stage (transformer) of the smaller of the two lamprey species (river lamprey) at point of entry into estuary systems averages about 10cm in length (Environment Agency, 2005), so could not pass through an eel screen of 2mm mesh size.
- 5.3.27 Impingement is also not a relevant consideration in relation to the passage and conservation status of adult lampreys as they are strong swimmers that can orientate themselves away from the margins of the river channel (Lucas & Bracken, 2010). Therefore, bankside water intakes are not likely to interact with adult lampreys and where present they would be able to escape the pull of water into the intake. Impingement is therefore very unlikely, and adult lamprey are too large to pass through standard fish/ eel screens. Additionally, their anguilliform body shape and burrowing behaviour means that they are well-protected from collision and abrasion if rare impingement events occur (Teague and Clough, 2014).
- 5.3.28 In contrast, lamprey transformers migrate primarily through drifting downstream and consequently are at much higher risk of impingement because they are not strong swimmers, with a maximum escape velocity of 0.3m/s (Environment Agency, 2005).
- 5.3.29 Acknowledging the potential risk of impingement, in reality this pathway does not exist as it is constrained by regulatory and permitting regimes. The Environment Agency, when giving advice on general requirements and eel screens, advised AECOM⁷ that the water abstraction velocity would not be permitted to exceed 0.25m/s at the lowest possible level at which maximum abstraction can take place i.e. the lowest astronomical tide level of -0.81m below ordnance datum. Therefore, the abstraction would be required to operate at a velocity that is below the maximum escape velocity for all life stages of the relevant lamprey species.
- 5.3.30 Given the commitment to appropriate screening at the water intake, should the River Water Abstraction Option be required and to operate the abstraction at or below the maximum permissible velocity, it is therefore concluded that impacts on European Sites from impingement or entrainment of lamprey at the potential

⁷ Correspondence between C Bradley (Environment Agency) and P McCambridge (AECOM) 8th July 2020.

water intake location on the River Trent will not result in LSE and can be screened out of Appropriate Assessment.

Impacts on Foraging Resources

- 5.3.31 The Humber Estuary SPA and Ramsar site is designated for breeding and overwintering birds that forage on invertebrates or small fish. Similarly, adult river lamprey will spend one to two years feeding on fish in estuaries before returning to breeding grounds (sea lamprey primarily feeds at sea, and ceases feeding before entering river systems on migration to breeding grounds).
- 5.3.32 Operation of the Proposed Development will not affect the estuary and mudflat habitats within the River Trent in the area for the reasons given above under habitat disturbance and modification and water pollution. Operational impacts on foraging resources is therefore screened out from Appropriate Assessment as it would not affect the conservation objectives.

5.4 Decommissioning Period

- 5.4.1 The potential impacts during decommissioning are considered comparable to or less than those associated with construction. Therefore, in accordance with the assessment of the construction phase, the potential impacts on European Sites will not result in LSE and can be screened out of Appropriate Assessment.

6.0 APPROPRIATE ASSESSMENT

6.1 Impact Pathways Screened in for Appropriate Assessment

- 6.1.1 The relevant impact pathway that could not be screened out at Stage 1 is atmospheric pollution arising during operation of the Proposed Development, specifically atmospheric pollution from operation of the Proposed PCC Site. This impact pathway is of relevance to all of the European Sites covered by this HRA.
- 6.1.2 To meet the requirements of the Planning Inspectorate, the completed 'Appendix 2 Screening Matrix' template required to comply with Advice Note Ten (The Planning Inspectorate, 2017) is provided in Appendix A.

6.2 Appropriate Assessment of Emissions to Air during Operation

- 6.2.1 As described above in Section 5.3, following AIA it was determined that in order to achieve BAT-AEL for NO_x emissions and to reduce the NO_x levels entering the CCP, abatement measures are required. As the NO_x abatement can result in an emission of ammonia, this also requires additional control or abatement. While abatement forms part of the committed design for the Proposed Development, for the purposes of compliant HRA, it needs to be considered a mitigation measure. As a consequence, further assessment is required as presented here.
- 6.2.2 The proposed design mitigation measure to address (abate) emissions of NO_x is installation of SCR. Thereafter, once cooled, the flue gases from the generating station will be introduced to one or more absorber column(s). In the column(s), the flue gases will be passed through a solvent that will remove the carbon dioxide from the gas stream. The solvent to be used is the subject of ongoing technical studies but is assumed to be an aqueous solution of amines. The alkaline nature of the solvent will mean that it will selectively absorb acidic gases such as carbon dioxide. Even with the use of SCR technology, it will not be possible to entirely remove NO_x or other impurities from the flue gases from the generating station.
- 6.2.3 Abatement of NO_x through the SCR process brings implications in terms of additional releases of ammonia (via 'ammonia slip'). Consequently, in addressing NO_x there is also a need for additional mitigation (abatement) measures to address ammonia, and this is also reflected in the design for the Proposed Development.
- 6.2.4 In addition, depending on the solvent (amine) solution used in the CCP, ammonia can be generated as a degradation product during the carbon capture process. As a technology licensor has not yet been chosen, there is uncertainty in the level of potential ammonia emission so a worst-case has been assumed. A flue gas washing unit will be located within the absorber column(s) to remove entrained solvent and also potentially ammonia from the flue gases, if required. The CO₂ lean flue gases (treated flue gas) will then be treated to remove entrained mist droplets.

- 6.2.5 The AIA, which is presented in full in **Chapter 8: Air Quality** (ES Volume I – **Application Document Ref. 6.2**), supplemented by **Appendix 8B: Air Quality – Operational Phase** (ES Volume II – **Application Document Ref. 6.3**), has therefore been undertaken, assuming implementation of the above abatement measures, which are reflected in the design of the Proposed Development (described in **Chapter 4: The Proposed Development** in ES Volume I – **Application Document Ref. 6.2**).
- 6.2.6 The AIA has been undertaken for the operational phase using detailed atmospheric dispersion modelling. The study area for the operational Proposed Development point source emissions extends up to 15km from the Proposed Development Site, in order to assess the potential impacts on European Sites in line with the Environment Agency risk assessment methodology (Defra and Environment Agency, 2016).
- 6.2.7 The modelled predicted impacts are those relating from the Proposed Development. These have been used to produce isopleth plots (contours) to enable an assessment of the process contribution (PC) and the predicted environmental concentrations (PEC) of NO_x and ammonia and the deposition of nitrogen and acidic atmospheric pollutants, at the identified European Sites.
- 6.2.8 The summary results of the atmospheric dispersion modelling of predicted impacts on European Sites are presented in the tables provided as Appendix B of this report. The tables set out the predicted PC to atmospheric concentrations of NO_x (Table B1) and ammonia (Table B2), and also the predicted nutrient nitrogen and acid deposition resulting from these emissions (Table B3 and B4). Accompanying figures are also included in **Appendix B**.
- 6.2.9 APIS provides information on site relevant critical levels for atmospheric NO_x concentrations for the protection of vegetation of 30µgm⁻³ and also critical levels of either 3µgm⁻³ or 1µgm⁻³ for ammonia (depending on the sensitivity of the species present, the critical level of 3µgm⁻³ being applicable to less sensitive higher plant species, and the critical level of 1µgm⁻³ being applicable to more sensitive lichen and bryophyte species). In addition, ecological studies have determined ‘critical loads’ for atmospheric nitrogen deposition (i.e. nitrogen derived from NO_x and ammonia) and acid deposition. Critical load criteria for the deposition of nitrogen and acid reflect the qualifying habitats and species present.
- 6.2.10 Of the European Sites requiring air quality assessment, only the Humber Estuary SAC and Ramsar site are located in close proximity to the Proposed Development, as they encompass the River Trent up to Keadby. European Sites and qualifying features located at a greater distance (to a maximum distance of 15km from the Proposed PCC Site) have also been addressed in the AIA.
- 6.2.11 As explained in Section 5.2 (paragraph 5.2.51), available guidance (CIEEM, 2021; Natural England 2018d) indicates that a project that will result in an increase of no more than 1% of critical loads or levels (either alone or in combination) can be regarded as insignificant in terms of air quality effects

irrespective of whether critical loads or levels are currently being exceeded at a site.

- 6.2.12 Following consideration of the proposed mitigation measures described above, the annual contribution of the Proposed Development to NO_x (in terms of the PC) is predicted to exceed 1% of the critical level at Humber Estuary SAC and Ramsar site due to its close proximity to the Proposed Development, but not at the other four European Sites under assessment. The relevant qualifying features of the Humber Estuary SAC and Ramsar site to which this exceedance of the critical level relates are estuaries and mudflats (as first identified in Section 4.3). However, the PEC (i.e. the existing baseline plus the Proposed Development emissions) reported for the Humber Estuary SAC and Ramsar site for NO_x is less than 70% of the critical level threshold for insignificance and no exceedances of the annual critical level are therefore predicted.
- 6.2.13 The annual contribution of the Proposed Development to ammonia (in terms of the PC) is not predicted to exceed 1% of the critical level at any of the European Sites, so is also less than the threshold for insignificance.
- 6.2.14 Since the critical levels will not be exceeded, the only relevant effect that may arise on habitats is through the role of NO_x and ammonia as nitrogen deposition, rather than through direct effects of the pollutants in the atmosphere. At all European Sites, the predicted PC of nutrient nitrogen is below 1% of the critical load, so is classified as insignificant. Acid deposition is also below 1% of the critical load at all European Sites, so is classified as insignificant.
- 6.2.15 There is also a need to consider potential impacts on species for which the European Sites are designated. In this case, for all relevant species (birds and lamprey) the broad habitats of relevance are covered by the critical levels and loads already assessed above. Accordingly, no species-specific impacts and effects are likely within the boundary of the European Sites as a result of operation of the Proposed Development.
- 6.2.16 There remains a residual consideration in relation to potential implications for functionally important habitats further upstream in the River Trent, beyond the boundary of the European Sites. APIS identifies that the potential sensitivity of lamprey species may need to be considered further in relation to nutrient nitrogen. However, in this case, this is not considered a relevant risk within the River Trent. In freshwater river habitats, including the River Trent (Natural England, 2015), phosphate is the principal growth-limiting nutrient rather than nitrogen, and conservation of such sites typically focuses on reducing phosphate levels rather than nitrogen levels. Phosphate does not derive from atmosphere. Given this, there are no LSE on lamprey habitats located upstream of the European Sites as a result of operation of the Proposed Development.
- 6.2.17 In conclusion, the AIA demonstrates that the proposed mitigation (abatement) measures which have been incorporated within the design of the Proposed Development are sufficient to manage atmospheric pollutants so that they remain below the critical levels/ loads set for all of the relevant European Sites.

Accordingly, it is concluded that there will be no adverse effect on the integrity of the relevant European Sites as a result of atmospheric emissions during operation of the Proposed Development.

7.0 IN-COMBINATION EFFECTS WITH OTHER PLANS OR PROJECTS

- 7.1.1 It is a requirement of Regulation 63(a) of the Habitats Regulations to not only assess the impacts of a development project alone, but also to investigate whether there might be ‘in-combination’ effects with other projects or plans (schemes).
- 7.1.2 For the purposes of this HRA, potentially relevant schemes which may act in-combination with the Proposed Development (see **Appendix D**) have been identified with reference to the information collated for **Chapter 19: Cumulative and Combined Effects (ES Volume I – Application Document Ref. 6.3)**.
- 7.1.3 There is only potential for in-combination effects where the Proposed Development has the same potential impact pathways as other schemes on the same European Sites. Based on the findings presented in Section 5 and 6 of this report, there are only potential pathways for in-combination effects from:
- noise and vibration during construction on the Humber Estuary SAC and Ramsar site;
 - emissions to air during construction on the Humber Estuary SAC and Ramsar site; and
 - emissions to air during operation of the Proposed PCC Site on all of the identified European Sites.
- 7.1.4 For all of the other impact pathways considered for the Proposed Development, the conclusions in relation to potential impacts on European Sites were no LSE due to the absence of a realistic pathway for impact or because the magnitude of impact was so small it could be considered *de minimis*. Given this, there is no potential for in-combination effects from these other impact pathways.
- 7.1.5 Most of the identified schemes, as screened in **Appendix D**, are confirmed to be of insufficient scale and/ or are located at too great a distance from the relevant European Sites to be likely to interact with the Proposed Development to produce a LSE through the above impact pathways. In two cases, schemes are of potential relevance during construction or operation but are insufficiently advanced or defined in the planning/ consenting process to be a certain part of the future baseline within which the Proposed Development needs to be assessed. Consequently, it is considered that these schemes will need to undertake their own HRA, including an in-combination assessment taking account of the Proposed Development, when they are ready to be submitted under the relevant consenting regimes. It will be the responsibility of these future schemes to consider the Proposed Development (the DCO for which will have been submitted at that time) when undertaking this process.
- 7.1.6 In specific relation to air quality impact assessment (**Chapter 8: Air Quality, ES Volume I - Application Document Ref. 6.2**), it should be noted that the assessment presented above in Sections 5 and 6 of this report has already

considered potential in-combination effects with relevant consented schemes (including the Keadby 2 Power Station) as this is a requirement of good practice air quality impact assessment methods. Specifically, the air quality impact assessment:

- confirms that cumulative impacts from existing sources of pollution in the area are accounted for in the adoption of site-specific background pollutant concentrations from archived and published sources; and
- recognises that there is a potential impact on local air quality from emission sources, and therefore considers relevant schemes identified in **Chapter 19: Cumulative and Combined Effects of the ES (ES Volume I - Application Document Ref. 6.2)** (as listed in Appendix D of this report).

7.1.7 Consequently, for certain schemes, potential in-combination air quality effects have already been assessed and, as the contribution from the Proposed Development is predicted to be insignificant from an air quality point of view and/or would not affect sensitive vegetation, there is no need to consider these schemes further (CIEEM, 2021. See paragraph 5.2.51). The relevant schemes are clarified in **Appendix D**.

7.1.8 Based on the information given in **Appendix D**, there are no likely in-combination effects associated with the Proposed Development and this can be screened out of Appropriate Assessment.

8.0 CONCLUSIONS

- 8.1.1 Following assessment of the potential pathways by which the Proposed Development might impact European Sites, alone or in-combination with other schemes, it is concluded that there is only one potential pathway for a LSE on European Sites. This potential effect relates to emissions to air from operation of the Proposed PCC Site within the Proposed Development.
- 8.1.2 Following Appropriate Assessment, and consideration of mitigation options which form part of the committed design of the Proposed Development, it is concluded that emissions to air would not have an adverse effect on the integrity of any European Sites.
- 8.1.3 Accordingly, it is not necessary to carry out any further stages of HRA.

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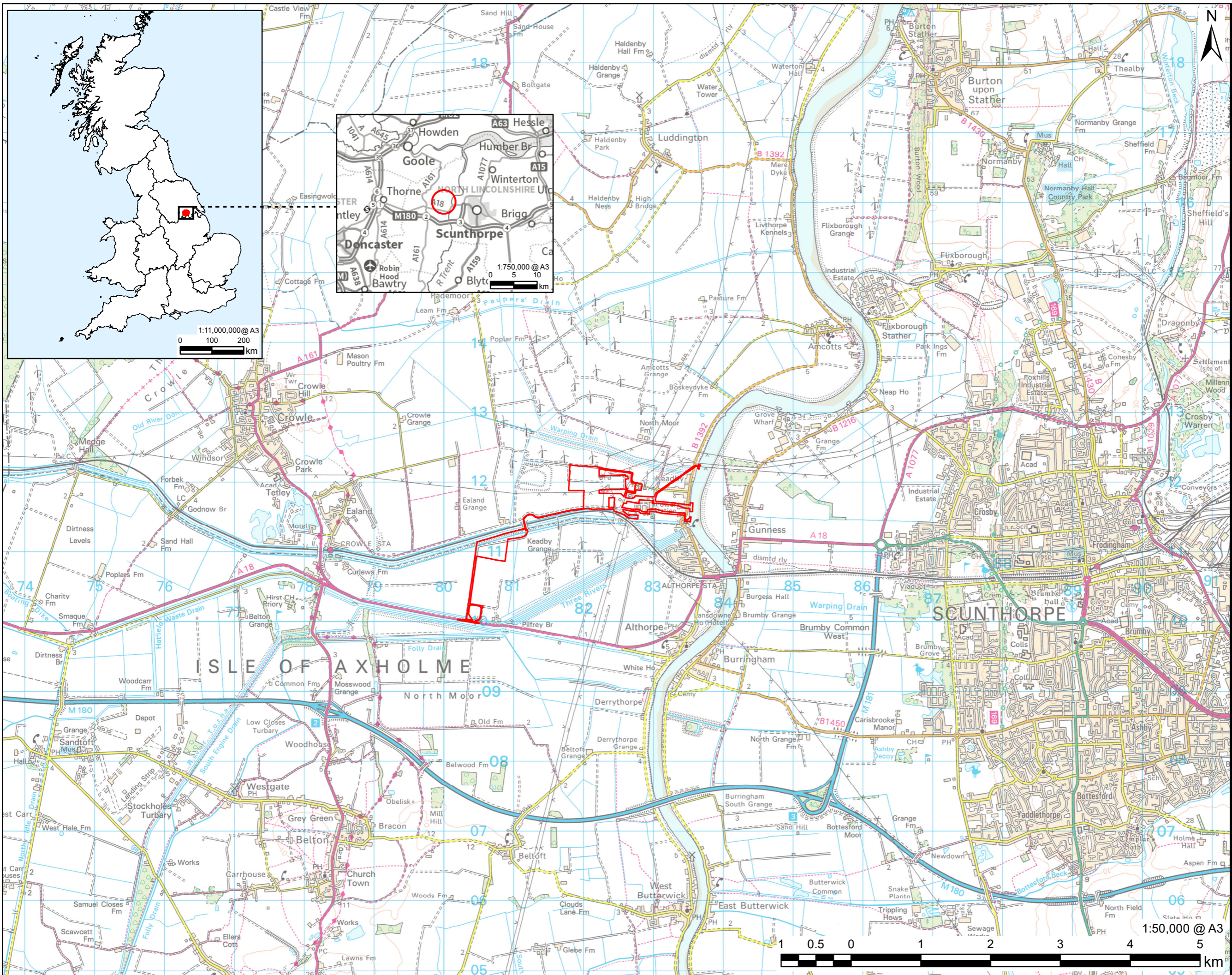
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FIGURES

Figure 1: Site Location Plan

Figure 2: European sites screened for likely significant effects



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PROJECT
The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

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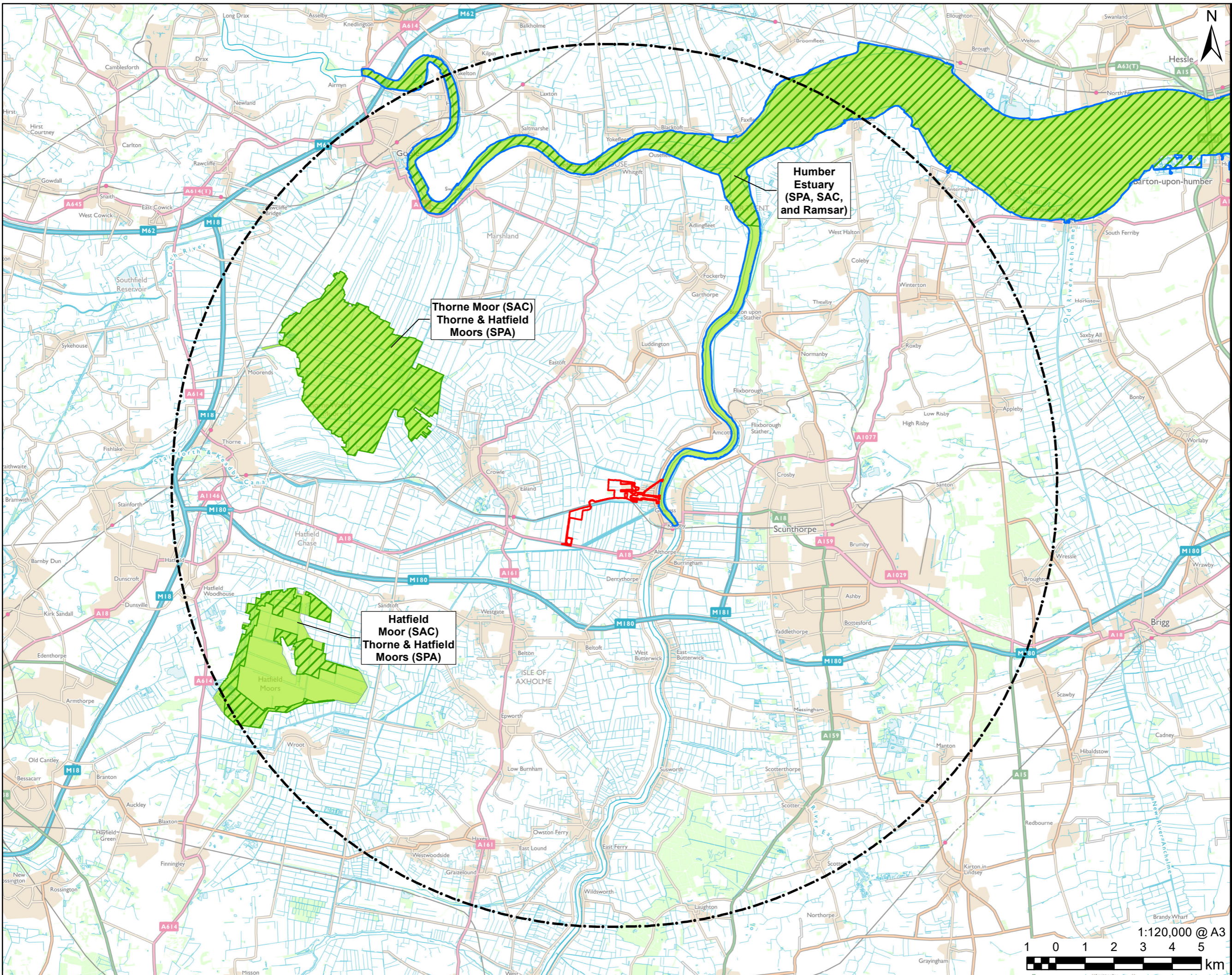
LEGEND
The Order Limits

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PROJECT NUMBER
60625943
SHEET TITLE
Site Location Plan
Figure 1
SHEET NUMBER
Application Document Ref No. 5.12

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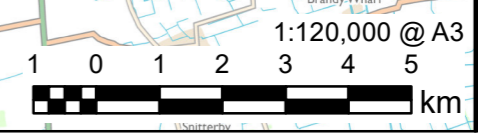
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- LEGEND**
- The Order Limits
 - 15km Study Area (Measured From Main Site)
 - Ramsar Site
 - Special Area of Conservation (SAC)
 - Special Protection Area (SPA)

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 European Sites Screened For Likely Significant Effects Figure 2
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APPENDIX A RELEVANT IMPACT PATHWAYS

A.1.1 The completed mandatory Appendix 1 screening templates required by Advice Note Ten (The Planning Inspectorate, 2017) are provided below and summarise (in the required format) the potential impacts of the Proposed Development on the identified relevant European Sites. This provides the basis for the more detailed screening assessment provided above in Section 5 of the main report.

A.1.2 The European Sites included within the screening assessment are:

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

A.1.3 The required information is provided below as follows:

- Table A1 – Summary effects considered within the screening matrices;
- HRA Screening Matrix 1 – Screening matrix for Humber Estuary SAC;
- HRA Screening Matrix 2 – Screening matrix for Humber Estuary SPA;
- HRA Screening Matrix 3 – Screening matrix for Humber Estuary Ramsar site;
- HRA Screening Matrix 4 - Screening matrix for Thorne Moor SAC;
- HRA Screening Matrix 5 - Screening matrix for Hatfield Moor SAC; and
- HRA Screening Matrix 6 - Screening matrix for Thorne and Hatfield Moors SPA.

Table A1: The impact pathways considered in this Habitats Regulations Assessment, which are referred to in the detailed screening matrices below.

Designation(s)	Impact Pathways identified on the current evidence base	Presented in Screening Matrices as
Humber Estuary SAC, SPA and Ramsar site	<p>Direct habitat disturbance and modification during construction, operation and decommissioning, including in terms of quality for dependent qualifying species.</p> <p>Visual and noise/ vibration disturbance of qualifying species during construction, operation and decommissioning.</p> <p>Entrapment of river and sea lamprey during operation and decommissioning.</p> <p>Spread of INNS during construction, operation and decommissioning.</p> <p>Emissions to atmosphere during construction, operation and decommissioning.</p> <p>Deterioration in water quality during construction, operation and decommissioning from a variety of sources, including thermal pollution.</p> <p>Temporary and/ or permanent effects on foraging resources of fish of qualifying bird and lamprey species during construction, operation and decommissioning.</p>	<p>Habitat disturbance and modification</p> <p>Visual and noise/ vibration disturbance</p> <p>Entrapment of lamprey</p> <p>INNS</p> <p>Atmospheric pollution</p> <p>Water quality</p> <p>Impacts on foraging resources</p>
Thorne Moor SAC, Hatfield Moor SAC and Thorne and Hatfield Moors SPA	Emissions to atmosphere during operation.	Atmospheric pollution

HRA Screening Matrix 1: Humber Estuary SAC

Within this table:

C = Construction

O = Operation

D = Decommissioning

✓ = Likely significant effect cannot be excluded

X = Likely significant effect can be excluded

NA = Not Applicable

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/ D	O	C/ D	O	C/ D	O	C/ D	O	C/ D	O	C/ D	O	C	O	C/D	O
Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Coastal lagoons		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O
Dunes with <i>Hippophae rhamnoides</i>		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Embryonic shifting dunes		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Estuaries		✓b	✓b	NA	NA	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	X	X	✓bgi	✓bgi
Fixed coastal dunes with herbaceous vegetation (“grey dunes”)		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Mudflats and sandflats not covered by seawater at low tide		✓b	✓b	NA	NA	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	X	X	✓bgi	✓bgi
<i>Salicornia</i> and other annuals colonizing mud and sand		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O
Sandbanks which are slightly covered by sea water all the time		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	√g	Xa	Xa	X	X	Xa	√g
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes");		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	√g	Xa	Xa	X	X	Xa	√g
Sea lamprey		√b	√b	√d	√c	√e	√e	Xf	Xf	√g	√g	√i	√i	√i	√i	√bdegi	√bdegi
River lamprey		√b	√b	√d	√c	√e	√e	Xf	Xf	√g	√g	√i	√i	√i	√i	√bdegi	√bdegi
Grey seal		Xa	Xa	Xa	Xa	NA	NA	Xf	Xf	Xh	Xh	Xaj	Xaj	Xa	Xa	Xah	Xah

-
- a. These qualifying habitats and species do not occur along the tidal River Trent at and downstream of the Proposed Development. At their closest, the identified habitats present potentially occur at Blacktoft Sands more than 9km to the north of the Proposed Development. No likely effect at distances concerned given the parameters of the Proposed Development.
 - b. These qualifying habitats and/ or species are present in association with the River Trent at the location of the Proposed Development.
 - c. While these species are likely to use the Humber Estuary SAC in the vicinity of the Proposed Development, there are no pathways for an operational visual and/ or noise and vibration disturbance impact on them given the location of the Proposed PCC Site, proposed access routes off the A18, and the operational parameters for the water intake and/ or outfall on the River Trent.
 - d. These species potentially occur within the construction and/ or operational zone of influence.
 - e. If a cofferdam is used during construction of the River Water Abstraction option (if required) then, depending on the timing of works (lamprey are only present during periods of migration), lamprey could become trapped in areas to be dewatered. During operation there is a theoretical risk of lamprey becoming trapped in water abstraction infrastructure, but again, only if the River Trent is used as the cooling water supply source. This pathway would not exist due to the requirements of regulators which have been considered during design of the Proposed Development. However, to provide clarity on this, this aspect it is further explained in in the main screening assessment (see Sections 5.2 and 5.3).
 - f. There are no likely pathways for impacts on species and habitats from INNS, given the existing baseline conditions (existing presence of INNS in River Trent and/ or no existing barriers to spread from connected watercourses affected by the Proposed Development). The proposed construction approach, as set out in the Framework CEMP (**Application Document Ref. 7.1**), includes mandatory biosecurity provision that also serves to close this pathway. However, to provide clarity on this aspect, it is further explained in the main screening assessment (see Section 5.2).
 - g. Habitats and species located within the worst-case study areas for construction and/ or operational air quality impact assessment and therefore require further screening (see Sections 5.2 and 5.3).
 - h. Species located and/ or primarily reliant on habitats located beyond the worst-case study areas for construction and/ or operational air quality impact assessment. No pathways for impact on that basis.
 - i. Species and habitats associated with, or potentially reliant on, aquatic and intertidal habitats of the River Trent.

HRA Screening Matrix 2: Humber Estuary SPA

Within this table:

C = Construction

O = Operation

D = Decommissioning

✓ = Likely significant effect cannot be excluded

X = Likely significant effect can be excluded

NA = Not Applicable

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O
<i>Botaurus stellaris</i> ; Great bittern (breeding and non-breeding)		Xa	Xa	Xa	Xa	NA	NA	Xe	Xe	Xg	✓f	Xai	Xai	Xai	Xai	Xag	✓f

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O
<i>Tadorna tadorna</i> ; Common shelduck (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefi	✓bdefh
<i>Circus aeruginosus</i> ; Eurasian marsh harrier (breeding)		Xa	Xa	Xa	Xa	NA	NA	Xe	Xe	Xg	✓f	Xai	Xai	Xai	Xai	Xagi	✓f
<i>Circus cyaneus</i> ; Hen harrier (non-breeding)		Xj	Xj	✓d	✓c	NA	NA	Xe	Xe	Xg	✓f	Xi	Xi	Xai	Xai	Xgi	✓f
<i>Recurvirostra avosetta</i> ; Pied avocet (breeding and non-breeding)		Xa	Xa	Xa	Xa	NA	NA	Xe	Xe	Xg	✓f	Xai	Xai	Xai	Xai	Xagi	✓f
<i>Pluvialis apricaria</i> ; European golden plover (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O		
<i>Calidris canutus</i> ; Red knot (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh
<i>Calidris alpina</i> ; Dunlin (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh
<i>Philomachus pugnax</i> ; Ruff (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh
<i>Limosa limosa islandica</i> ; Black-tailed godwit (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh
<i>Limosa lapponica</i> ; Bar-tailed godwit (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh
<i>Tringa totanus</i> ; Common redshank (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/ D	O	C/ D	O	C/ D	O	C/ D	O	C/ D	O	C/ D	O	C	O	C/D	O
<i>Sterna albifrons</i> ; Little tern (breeding)		Xa	Xa	Xa	Xa	NA	NA	Xe	Xe	Xg	✓f	Xai	Xai	Xa	Xa	Xag	✓f
Water bird assemblage		✓b	✓b	✓d	✓c	NA	NA	Xe	Xe	✓f	✓f	✓h	✓h	✓h	✓h	✓bdefh	✓bdefh

- These qualifying species do not occur along the tidal River Trent at and downstream of the Proposed Development. At their closest, the identified habitats potentially occur at Blacktoft Sands more than 9km to the north of the Proposed Development. No likely effect at distances concerned given the parameters of the Proposed Development.
- These qualifying species are present in association with the River Trent at the location of the Proposed Development. In the case of birds, the affected habitat is not part of the Humber Estuary SPA, but it may be considered functionally linked and is otherwise of potential relevance in the context of the Humber Estuary Ramsar site.
- While these species are likely to occur (outside the boundary of the SPA) in the vicinity of the Proposed Development, there are no likely pathways for a visual and/ or noise and vibration disturbance impact on them given the location of the Proposed PCC Site, proposed access routes off the A18, and the operational parameters for the water intake and/ or outfall on the River Trent.
- These species potentially occur within the construction and/ or operational zone of influence.

-
- e. There are no likely pathways for impacts on species from INNS, given the existing baseline conditions (existing presence of INNS in River Trent and/ or no existing barriers to spread from connected watercourses affected by the Proposed Development). The proposed construction approach, as set out in the Framework CEMP (**Application Document Ref. 7.1**), includes mandatory biosecurity provision that also serves to close this pathway. However, to provide clarity on this aspect, it is further explained in the main screening assessment (see Section 5.2).
 - f. These are species located within the worst-case study areas for construction and/ or operational air quality impact assessment and therefore require further screening (see Sections 5.2 and 5.3).
 - g. Species located and/ or primarily reliant on habitats located beyond the worst-case study areas for construction and/ or operational air quality impact assessment. No pathways for impact on that basis.
 - h. Species associated with, or potentially reliant on, aquatic and intertidal habitats of the River Trent. In the case of birds, the affected habitat is not part of the Humber Estuary SPA, but it may be considered functionally linked.
 - i. These bird species do not rely on the River Trent and its mudflats for foraging and maintenance of conservation status.

HRA Screening Matrix 3: Humber Estuary Ramsar site

Within this table:

C = Construction

O = Operation

D = Decommissioning

✓ = Likely significant effect cannot be excluded

X = Likely significant effect can be excluded

NA = Not Applicable

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O
Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Coastal lagoons		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O
Dunes with <i>Hippophae rhamnoides</i>		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Embryonic shifting dunes		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Estuaries		✓b	✓b	NA	NA	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	X	X	✓bgi	✓bgi
Fixed coastal dunes with herbaceous vegetation (“grey dunes”)		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g
Mudflats and sandflats not covered by seawater at low tide		✓b	✓b	NA	NA	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	X	X	✓bgi	✓bgi
<i>Salicornia</i> and other annuals colonizing mud and sand		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	✓g	Xa	Xa	X	X	Xa	✓g

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		Stage of Proposed Development	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O	
Sandbanks which are slightly covered by sea water all the time		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	√g	Xa	Xa	X	X	Xa	√g
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes");		Xa	Xa	NA	NA	NA	NA	Xf	Xf	Xa	√g	Xa	Xa	X	X	Xa	√g
Sea lamprey		√b	√b	√d	√c	√e	√e	Xf	Xf	√g	√g	√i	√i	√i	√i	√bdegi	√bdegi
River lamprey		√b	√b	√d	√c	√e	√e	Xf	Xf	√g	√g	√i	√i	√i	√i	√bdegi	√bdegi
Grey seal		Xa	Xa	Xa	Xa	NA	NA	Xf	Xf	Xh	Xh	Xaj	Xaj	Xa	Xa	Xah	Xah

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O
<i>Tadorna tadorna</i> ; Common shelduck (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi
<i>Pluvialis apricaria</i> ; European golden plover (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi
<i>Calidris canutus</i> ; Red knot (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi
<i>Calidris alpina</i> ; Dunlin (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi
<i>Limosa limosa islandica</i> ; Black-tailed godwit (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi

Qualifying features	Effect	Habitat disturbance and modification		Visual and noise/vibration disturbance		Entrapment of lamprey		Invasive non-native species		Atmospheric pollution		Water quality		Impacts on foraging resources		In-combination effects	
		Stage of Proposed Development	C/D	O	C/D	O	C/D	O	C/D	O	C/D	O	C	O	C/D	O	
<i>Limosa lapponica</i> ; Bar-tailed godwit (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi
<i>Tringa totanus</i> ; Common redshank (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi
Water bird assemblage (non-breeding)		✓b	✓b	✓d	✓c	NA	NA	Xf	Xf	✓g	✓g	✓i	✓i	✓i	✓i	✓bdfgi	✓bdfgi
Natterjack toad		Xa	Xa	Xa	Xa	NA	NA	Xa	Xa	Xh	Xh	Xa	Xa	Xa	Xa	Xah	Xah

- These qualifying habitats and species do not occur along the tidal River Trent at and downstream of the Proposed Development. At their closest, the identified habitats present potentially occur at Blacktoft Sands more than 9km to the north of the Proposed Development. No likely effect at distances concerned given the parameters of the Proposed Development.
- These qualifying habitats and/ or species are present in association with the River Trent at the location of the Proposed Development.

-
- c. While these species are likely to use the Humber Estuary Ramsar site in the vicinity of the Proposed Development, there are no likely pathways for a visual and/ or noise and vibration disturbance impact on them given the location of the Proposed PCC Site, proposed access routes off the A18, and the operational parameters for the water intake and/ or outfall on the River Trent.
 - d. These species potentially occur within the construction and/ or operational zone of influence.
 - e. If a cofferdam is used during construction of the River Water Abstraction option (if required) then, depending on the timing of works (lamprey are only present during periods of migration), lamprey could become trapped in areas to be dewatered. During operation there is a theoretical risk of lamprey becoming trapped in water abstraction infrastructure, but again, only if the River Trent is used as the cooling water supply source. This pathway would not exist due to the requirements of regulators which have been considered during design of the Proposed Development. However, to provide clarity on this, this aspect it is further explained in in the main screening assessment (see Sections 5.2 and 5.3).
 - f. There are no likely pathways for impacts on species and habitats from INNS, given the existing baseline conditions (existing presence of INNS in River Trent and/ or no existing barriers to spread from connected watercourses affected by the Proposed Development). The proposed construction approach, as set out in the Framework CEMP (**Application Document Ref. 7.1**), includes mandatory biosecurity provision that also serves to close this pathway. However, to provide clarity on this aspect, it is further explained in the main screening assessment (see Section 5.2).
 - g. Habitats and species located within the worst-case study areas for construction and/ or operational air quality impact assessment and therefore require further screening (see Sections 5.2 and 5.3).
 - h. Species located and/ or primarily reliant on habitats located beyond the worst-case study areas for construction and/ or operational air quality impact assessment. No pathways for impact on that basis.
 - i. Species and habitats associated with, or potentially reliant on, aquatic and intertidal habitats of the River Trent.
 - j. These bird species do not rely on the River Trent and its mudflats for foraging and maintenance of conservation status.

HRA Screening Matrix 4: Thorne Moor SAC

Within this table:

C = Construction

O = Operation

D = Decommissioning

✓ = Likely significant effect cannot be excluded

X = Likely significant effect can be excluded

NA = Not Applicable

Qualifying features	Effect	Atmospheric pollution		In-combination effects	
	Stage of Proposed Development	C/ D	O	C/D	O
Degraded raised bogs still capable of natural regeneration		Xa	✓b	Xa	✓b

- Located well beyond the worst-case 500m study area for construction air quality impact assessment and therefore there is no potential for significant air quality effects. At the closest point these designations are 8.2km from the Proposed Development.
- Habitat located within the worst-case 15km study area for operational air quality impact assessment and therefore requires further screening (see Section 5.3 of the main assessment).

HRA Screening Matrix 5: Hatfield Moor SAC

Within this table:

C = Construction

O = Operation

D = Decommissioning

✓ = Likely significant effect cannot be excluded

X = Likely significant effect can be excluded

NA = Not Applicable

Qualifying features	Effect	Atmospheric pollution		In-combination effects	
	Stage of Proposed Development	C/ D	O	C/D	O
Degraded raised bogs still capable of natural regeneration		Xa	✓b	Xa	✓b

- Located well beyond the worst-case 500m study area for construction air quality impact assessment and therefore there is no potential for significant air quality effects. At the closest point these designations are 8.2km from the Proposed Development.
- Habitat located within the worst-case 15km study area for operational air quality impact assessment and therefore requires further screening (see Section 5.3 of the main assessment).

HRA Screening Matrix 6: Thorne and Hatfield Moors SPA

Within this table:

C = Construction

O = Operation

D = Decommissioning

✓ = Likely significant effect cannot be excluded

X = Likely significant effect can be excluded

NA = Not Applicable

Qualifying features	Effect	Atmospheric pollution		In-combination effects	
	Stage of Proposed Development	C/ D	O	C/D	O
<i>Caprimulgus europaeus</i> ; European nightjar (breeding)		Xa	✓b	Xa	✓b

- At the closest point these designations are 8.2km from the Proposed Development, so too distant for any reasonable likelihood of direct impacts on nightjar. The SPA is well beyond the worst-case 500m study area for construction/ decommissioning air quality impact assessment and therefore there is no potential for significant construction/ decommissioning air quality effects.
- Species dependent on habitats located within the worst-case 15km study area for operational air quality impact assessment and therefore requires further screening (see Section 5.3 of the main assessment).

APPENDIX B RESULTS OF THE OPERATION AIR QUALITY ASSESSMENT

Table B1: NO_x Dispersion modelling results for ecological receptors

Receptor ID	Site Name	Annual average (µg/m ³)						24-hour average (µg/m ³)					
		CL	PC	PC % of CL	BC	PEC	PEC % of CL	CL	PC	PC % of CL	BC	PEC	PEC % of CL
OE1-5	Humber Estuary Ramsar/ SAC/ SSSI	30	0.49	1.6%	13.7	14.23	47%	75	9.9	13%	20.6	30.5	41%
OE10	Thorne Moor SAC and SPA		0.05	0.2%	11.2	11.25	38%		1.7	2%	16.8	18.6	25%
OE13	Hatfield Moor SAC and SPA		0.03	0.1%	11.7	11.78	39%		1.4	2%	17.6	19.1	25%
OE32	Humber Estuary (at Blacktoft Sands) Ramsar, SAC, SPA and SSSI		0.13	0.4%	13.1	13.19	44%		1.4	2%	19.6	21.0	28%

CL = Critical Level, PC = Process Contribution, BC = Background Concentration (modified to include the contribution from the Keadby 2 Power Station), PEC = Predicted Environmental Concentration

Table B2: Dispersion modelling results for ecological receptors – NH₃

Receptor ID	Site Name	Annual Average (µg/m ³)					
		CL	PC	PC % of CL	BC	PEC	PEC % of CL
OE1-5	Humber Estuary SSSI, SAC, Ramsar	3	0.02	0.5%	2.36	2.38	79%
OE10	Thorne Moor SAC and SPA	1	0.002	0.2%	2.60	2.60	260%
OE13	Hatfield Moor SAC and SPA	1	0.001	0.1%	2.39	2.40	240%
OE32	Humber Estuary (at Blacktoft Sands) Ramsar, SPA, SAC and SSSI	3	0.004	0.1%	1.89	1.91	64%

CL = Critical Level, PC = Process Contribution, BC = Background Concentration (modified to include the contribution from the Keadby 2 Power Station), PEC = Predicted Environmental Concentration

Table B3: Dispersion modelling results for ecological receptors – Nutrient nitrogen deposition (Kg N/ha/yr)

Receptor ID	Site name	Background nitrogen deposition ¹ (kg N/ha/yr)	Most stringent Critical Load class applicable for the site	Lower value of applicable Critical Load range	PC (kg N/ha/yr)	PC % Critical Load	PEC (kg N/ha/yr)	PEC % Critical Load
OE1-5	Humber Estuary Ramsar, SSSI, SAC	20.2	Pioneer, Low-mid, mid-upper saltmarshes	20	0.13	0.7%	20.4	102%
OE10	Thorne Moor SAC	21.3	Degraded Raised Bogs	5	0.01	0.2%	21.3	426%
OE13	Hatfield Moor SSSI	20.9	Raised and blanket bogs	5	0.01	0.2%	20.9	418%
OE32	Humber Estuary at Blacktoft Sands (Ramsar, SAC, SPA and SSSI)	18.2	Rich Fens	15	0.04	0.2%	18.2	121%

¹ The background concentration has been modified to include the contribution from the Keadby 2 Power Station

Table B4: Dispersion modelling results for ecological receptors – Acid deposition N (Keq/ha/yr)

Recept or ID	Site name	Acid deposition				PC acid deposition (keq/ha/yr)		
		Critical Load (keq/ha/yr)	Baseline ¹ (keq/ha/yr)	Lowest Critical Load class applicable	Baseline % of Critical Load	PC	PC % of Critical Load	PEC% of Critical Load
OE1-5	Humber Estuary Ramsar / SAC/ SSSI	Pioneer, Low-mid, mid-upper saltmarshes – not sensitive to acidity						
OE10	Thorne Moor SAC and SPA	Min CL Min N: 0.321 Min CL Max N: 0.462 Min CL Max S: 0.141	N: 1.5 S: 0.2	Bogs	374%	0.001	0.0%	374%
OE13	Hatfield Moor SAC and SPA	Min CL Min N: 0.321 Min CL Max N: 0.475 Min CL Max S: 0.154	N: 1.5 S: 0.2	Bogs	356%	0.001	0.0%	356%
OE32	Humber Estuary at Blacktoft Sands (Ramsar, SAC, SPA and SSSI)	Fen, Marsh and Swamp - Not sensitive to acidity						

¹ The background concentration has been modified to include the contribution from the Keadby 2 Power Station

APPENDIX C EFFECTS ON INTEGRITY

C.1.1 The completed mandatory Appendix 2 screening template matrices required by Advice Note Ten (The Planning Inspectorate, 2017) are provided below. The purpose of the matrices is to confirm the potential LSE requiring Appropriate Assessment based on the potential impact pathways identified in Annex A of this report and the detailed examination of the potential impact pathways provided in section 5 of this HRA report. Therefore, the matrices do not list LSE that have already been excluded with section 5 of the main report.

C.1.2 The European Sites listed below have been subject to further assessment in order to establish if the NSIP could have an adverse effect on their integrity:

- Humber Estuary SAC (HRA Integrity Matrix 1);
- Humber Estuary SPA (HRA Integrity Matrix 2);
- Humber Estuary Ramsar site (HRA Integrity Matrix 3);
- Thorne Moor SAC (HRA Integrity Matrix 4);
- Hatfield Moor SAC (HRA Integrity Matrix 5); and
- Thorne and Hatfield Moors SPA (HRA Integrity Matrix 6).

C.1.3 The required Appropriate Assessment is provided in Section 6 of this HRA report, which should be referred to for the conclusions on whether there is a likely effect on the integrity of any European Sites.

C.1.4 Within the following matrices:

O = Operation

✓ = Adverse effect on integrity cannot be excluded

X = Adverse effect on integrity can be excluded

NA = Not Applicable

HRA Integrity Matrix 1: Humber Estuary SAC

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)		✓a
Coastal lagoons		✓a
Dunes with <i>Hippophae rhamnoides</i>		✓a
Embryonic shifting dunes		✓a
Estuaries		✓a

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
Fixed coastal dunes with herbaceous vegetation ("grey dunes")		✓a
Mudflats and sandflats not covered by seawater at low tide		✓a
<i>Salicornia</i> and other annuals colonizing mud and sand		✓a
Sandbanks which are slightly covered by sea water all the time		✓a
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes");		✓a
Sea lamprey		✓b
River lamprey		✓b
Grey seal		Xc

- The identified habitats occur within the 15km study area. Through the air quality impact assessment, it was determined that abatement of NOx and ammonia emissions would be necessary. For the purposes of this HRA, such abatement measures constitute mitigation and consequently cannot be considered until HRA stage 2 i.e. Appropriate Assessment. Appropriate Assessment is required. This is provided in Section 6 of this report.
- Species for which LSE cannot be discounted due to their being a potential air quality impact on key habitats.
- Species located and/ or primarily reliant on habitats located beyond the worst-case study areas for construction and/ or operational air quality impact assessment. No pathways for impact on that basis.

HRA Integrity Matrix 2: Humber Estuary SPA

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
<i>Botaurus stellaris</i> ; Great bittern (breeding and non-breeding)		✓a
<i>Tadorna tadorna</i> ; Common shelduck (non-breeding)		✓a
<i>Circus aeruginosus</i> ; Eurasian marsh harrier (breeding)		✓a
<i>Circus cyaneus</i> ; Hen harrier (non-breeding)		✓a

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
<i>Recurvirostra avosetta</i> ; Pied avocet (breeding and non-breeding)		✓a
<i>Pluvialis apricaria</i> ; European golden plover (non-breeding)		✓a
<i>Calidris canutus</i> ; Red knot (non-breeding)		✓a
<i>Calidris alpina alpina</i> ; Dunlin (non-breeding)		✓a
<i>Philomachus pugnax</i> ; Ruff (non-breeding)		✓a
<i>Limosa limosa islandica</i> ; Black-tailed godwit (non-breeding)		✓a
<i>Limosa lapponica</i> ; Bar-tailed godwit (non-breeding)		✓a
<i>Tringa totanus</i> ; Common redshank (non-breeding)		✓a
<i>Sterna albifrons</i> ; Little tern (breeding)		✓a
Water bird assemblage		✓a

- a. Species for which LSE cannot be discounted due to their being a potential air quality impact on key habitats.

HRA Integrity Matrix 3: Humber Estuary Ramsar Site

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)		✓a
Coastal lagoons		✓a
Dunes with <i>Hippophae rhamnoides</i>		✓a
Embryonic shifting dunes		✓a
Estuaries		✓a
Fixed coastal dunes with herbaceous vegetation ("grey dunes")		✓a
Mudflats and sandflats not covered by seawater at low tide		✓a
<i>Salicornia</i> and other annuals colonizing mud and sand		✓a

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
Sandbanks which are slightly covered by sea water all the time		✓a
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes");		✓a
Sea lamprey		✓b
River lamprey		✓b
Grey seal		Xc
<i>Tadorna tadorna</i> ; Common shelduck (non-breeding)		✓b
<i>Pluvialis apricaria</i> ; European golden plover (non-breeding)		✓b
<i>Calidris canutus</i> ; Red knot (non-breeding)		✓b
<i>Calidris alpina alpina</i> ; Dunlin (non-breeding)		✓b
<i>Limosa limosa islandica</i> ; Black-tailed godwit (non-breeding)		✓b
<i>Limosa lapponica</i> ; Bar-tailed godwit (non-breeding)		✓b
<i>Tringa totanus</i> ; Common redshank (non-breeding)		✓b
Water bird assemblage		✓b
Natterjack toad		Xc

- a. The identified habitats occur within the 15km study area. Through the air quality impact assessment, it was determined that abatement of NOx and ammonia emissions would be necessary. For the purposes of this HRA, such abatement measures constitute mitigation and consequently cannot be considered until HRA stage 2 i.e. Appropriate Assessment. Appropriate Assessment is required. This is provided in Section 6 of this report.
- b. Species for which LSE cannot be discounted due to their being a potential air quality impact on key habitats.
- c. Species located and/ or primarily reliant on habitats located beyond the worst-case study areas for construction and/ or operational air quality impact assessment. No pathways for impact on that basis.

HRA Integrity Matrix 4: Thorne Moor SAC

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
Degraded raised bogs still capable of natural regeneration		✓a

- a. The identified habitats occur within the 15km study area. Through the air quality impact assessment, it was determined that abatement of NOx and ammonia emissions would be necessary. For the purposes of this HRA, such abatement measures constitute mitigation and consequently cannot be considered until HRA stage 2 i.e. Appropriate Assessment. Appropriate Assessment is required. This is provided in Section 6 of this report.

HRA Integrity Matrix 5: Hatfield Moor SAC

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
Degraded raised bogs still capable of natural regeneration		✓a

- a. The identified habitats occur within the 15km study area. Through the air quality impact assessment, it was determined that abatement of NOx and ammonia emissions would be necessary. For the purposes of this HRA, such abatement measures constitute mitigation and consequently cannot be considered until HRA stage 2 i.e. Appropriate Assessment. Appropriate Assessment is required. This is provided in Section 6 of this report.

HRA Integrity Matrix: Thorne and Hatfield Moors SPA

Qualifying features	Effect	Atmospheric pollution
	Stage of Proposed Development	O
<i>Caprimulgus europaeus</i> ; European nightjar (breeding)		✓a

- a. Species for which LSE cannot be discounted due to their being a potential air quality impact on key habitats.

APPENDIX D OTHER PLANS AND PROJECTS OF POTENTIAL RELEVANCE TO THE IN-COMBINATION ASSESSMENT

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
1	Humber Low Carbon Pipelines PINS Ref: EN070006	<p>Development of 'Zero Carbon Industrial Cluster' with the principle area of interest being the construction of a CO₂ transport and storage system across the Humber region.</p> <p>Strategic proposals also encompass a Hydrogen demonstration and test facility, installation of carbon capture technology at Drax Power Station and a geologically secure long-term CO₂ storage facility in the North Sea.</p> <p>Application listed on PINS' National Infrastructure Planning website: DCO Application anticipated to be submitted to PINS in Q3 2022.</p>	<p>Scoped out of in-combination assessment.</p> <p>The Proposed Development has been sited to be able to connect into the emerging proposals for the Humber Low Carbon Pipeline carbon dioxide (CO₂) pipeline. This scheme is currently at pre-feasibility stage and a detailed design is therefore not available for purposes of in-combination assessment. It is assumed that the CO₂ pipeline could be constructed in parallel with the Proposed Development, which would allow commercial operation of the Proposed Development to commence at the earliest in late 2026. Or it may be the case that construction of the Humber Low Carbon pipeline proposals occurs later than construction of the Proposed Development commences, and construction timescales would therefore not overlap. Construction of the pipeline, if it were to coincide with the Proposed Development construction, will result in cumulative effects. However, it is not possible to fully assess those cumulative effects until the details of the Humber Low Carbon pipeline are available - an assessment on the basis of the best available information is therefore included within Chapter 19: Cumulative and Combined Effects (ES Volume I – Application Document Ref. 6.2).</p> <p>It is noted that a detailed cumulative assessment will be included as part of the Humber Low Carbon Pipeline</p>

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
			<p>application and that it will be a requirement for the National Grid Carbon – the pipeline proposer, to take account of the effects of the Proposed Development as a committed development.</p> <p>It is envisaged that the mechanism by which any likely significant cumulative effects found within the Humber Low Carbon Pipeline DCO application(s) would be taken into account within the Proposed Development would be, for example, in the form of updates to Proposed Development CEMP and construction method statements to accommodate any likely cumulative effects once known.</p> <p>On the assumption that construction of the Proposed Development would commence before construction of the Humber Low Carbon Pipeline but that construction timescales could overlap, it is unlikely that construction works in-combination would exceed the 70db threshold set for an adverse noise effect on birds (see Section 5 of this report) given the conclusions of the noise modelling for the Proposed Development in isolation. The worst-case noise levels during the main civils works for the Proposed Development (i.e. the locations where the Proposed Development would construct pipeline connections) for the Proposed Development would be no more than 40dB. Noise levels arising from pipeline construction would reasonably not give rise to levels which in combination would be classed as significant.</p> <p>Given the nature of the Humber Low Carbon Pipeline, operation would not result in emissions to air that could be</p>

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
			relevant to this in-combination assessment. So, there is no pathway for an in-combination operational effect.
2	Keadby 2 Keadby II S36 Consent	Keadby Developments Limited (part of SSE). Keadby 2 Section 36 Variation Application(s) 2016/2017/2018	Scoped out of in-combination assessment. As the construction period for Keadby 2 Power Station is due to be completed early in 2022, before the Proposed Development construction period commences, there is no potential for cumulative construction phase impacts and effects. Operationally, the Keadby 2 Power Station project is considered as part of the baseline and is scoped out of Chapter 19: Cumulative and Combined Effects (ES Volume I – Application Document Ref. 6.2) .
3	Keadby Wind Farm Extension EN010070	SSE. Keadby Windfarm Extension	Scoped out of in-combination assessment. Planning Inspectorate (DCO) Project on hold as of 27/05/15. The Applicant has confirmed that there are no plans to take this project forward at the present time.
4	Biodiversity Enhancement Area PA/2020/952	Keadby Developments Limited (part of SSE). Keadby Developments Limited (part of SSE). Planning permission for the creation of a Biodiversity Enhancement Area (comprising the use of 70,000 m ³ of excavated soil).	Scoped out of in-combination assessment. Scheme currently refused planning permission. Minor scheme with biodiversity purpose. No potential for adverse in-combination effects.
5	30 residential dwellings at Old Railway	WFW Development Ltd. Erect 30 affordable dwellings with associated access and other works, Old Railway Sidings, A18 From Althorpe To	Scoped out of in-combination assessment. Located in Althorpe village 1km away from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
	Sidings PA/2019/1904	Gunness, Althorpe, DN17 3HN. Refused planning permission (at the time of submission)	influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
6	27 residential dwellings PA/2017/1513	Roger Burnett Promotions, Retirement & Death Benefit Scheme. Outline planning permission granted to erect 27 dwellings with access and layout to be determined and all other matters reserved for subsequent approval, Land off the A18, Althorpe	Scoped out of in-combination assessment. Located within the existing curtilage of Althorpe village, 1km away from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed
7	14 residential dwellings at Old Railway Sidings PA/2017/464	Mr T Webster. Outline planning permission granted for up to 14 dwellings. Yet to be built.	Scoped out of in-combination assessment. Not relevant as superseded by Scheme 5 (above), which is a resubmission for a larger development.
8	Mixed use development. PA/2020/660	Rafkins (Scunthorpe) Leisure Park Limited. Planning application for mixed use development – hotel (Class C1), gym (Class D2), retail units (Class A1), food and drink and drive-thru restaurants (Class A3/A5) – access, car parking, landscaping and associated works. Approved 27/04/21.	Scoped out of in-combination assessment. 2km from the Humber Estuary SAC and Ramsar site and located within the existing curtilage of Scunthorpe. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
9	11 industrial units. PA/2019/1807	Mr Singh. Application to erect 11 industrial units. Not determined.	Scoped out of in-combination assessment. 3.4km from the Humber Estuary SAC and Ramsar site and located within the existing curtilage of Scunthorpe. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed
10	North Lincolnshire Green Energy Park North Lincolnshire Green Energy Park PINS Ref. EN010116	North Lincolnshire Green Energy Park Limited. DCO for an energy Recovery Facility converting up to 650,000 tonnes per annum of Refuse Derived Fuel (RDF) to generate a maximum of 95 megawatts of electrical output (MWe) and/or 380 Mega Watts of thermal output (MWt) to provide power, heat and steam on the site of the operating Flixborough Wharf on the River Trent. Expected to be submitted to the Planning Inspectorate in Q3 2021.	Scoped out of in-combination assessment. This scheme is at an early stage (EIA scoping opinion received) and consequently the DCO for the Proposed Development will have been submitted prior to any application for this scheme. The scoping report (ERM, 2020) notes that 'assuming that the DCO Application is submitted in Q3 2021, the earliest approval would be Q4 2022. Construction would therefore begin no sooner than Q1 2023 and will take three years to complete. Operation is expected to begin in 2025/26 and to operate for 25-40 years. A technology refresh would be anticipated by 2050/51, subject to future changes in technology'. Based on available information, there is potential for an in-combination air quality effect which will be assessed in Chapter 19: Cumulative and Combined Effects of the ES , using available information. However, it will be the responsibility of the developer to consider the Proposed Development as part of the future baseline to meet legal requirements for HRA.

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
11	Residential development PA/2017/824	Mr C Muscroft. Outline application for residential a development. Submitted but not determined.	Scoped out of in-combination assessment. 5.3km from the Humber Estuary SAC and Ramsar site and located within the existing curtilage of Crowle. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
12	144 dwellings. PA/2020/1333	DDM Agriculture Ltd. Outline application to erect 144 dwellings with appearance, landscaping, layout and scale reserved for subsequent consideration. Submitted but not determined.	Scoped out of in-combination assessment. 3km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
13	88 dwellings. PA/2019/1607	Harron Homes. Application to erect 88 dwellings with associated roads, drainage, service infrastructure and public open space (including demolition of existing agricultural buildings). Submitted but not determined.	Scoped out of in-combination assessment. 4km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
14	Engineering operations for railway line	Mr Bailey – Crowle Peatland Railway Society. Application to carry out engineering operations in connection with laying a 373 m	Scoped out of in-combination assessment. 8.4km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
	extension. PA/2020/537	railway line extension and construction of two railway platforms 12.2m x 2.3m. Submitted but not determined.	traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
15	Residential development (110 dwellings) PA/2020/1207	Moorwalk Limited Outline application for residential development (up to 110 dwellings), with public open spaces, the creation of a play area and sustainable drainage systems (SUDs) including detention basins with appearance, landscaping, layout and scale reserved for subsequent consideration. Refused permission	Scoped out of in-combination assessment. 6.2km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
16	88 dwellings PA/2019/1088	Linden Homes. Application to erect 88 dwellings with associated access, drainage and landscaping. Approved 19/02/21.	Scoped out of in-combination assessment. 6.4km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
17	122 dwellings PA/2019/1107	Linden Homes. Application to erect 122 dwellings with associated access, drainage and landscaping. Submitted but undetermined.	Scoped out of in-combination assessment. 7.8km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.

ID	Application reference	Applicant for 'other development' and a brief description	Potential for in-combination effects
18	Little Crow Solar Park Little Crow Solar Park	INRG SOLAR (Little Crow) Ltd. DCO energy scheme comprising ground mounted solar photovoltaic arrays, electrical storage, grid connection infrastructure and other infrastructure integral to the construction and/or operation of the energy scheme. The solar park will have an installed maximum capacity of 150MW and battery storage of up to 90MW. Application submitted and in DCO Examination.	Scoped out of in-combination assessment. 9.1km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
19	66 dwellings PA/2019/1414	Mark Simmonds Planning Services. Outline application for residential development of up to 66 dwellings with all matters reserved or subsequent approval. Submitted but undetermined.	Scoped out of in-combination assessment. 6.4km from the Humber Estuary SAC and Ramsar site. Too distant to contribute to an in-combination effect through construction noise and vibration. Not in zone of influence for a construction traffic in-combination effect. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.
20	Solar PV farm and associated infrastructure 20/01345/FUL	Lightsource BP. Variation of condition 3 of planning permission 14/01554/FULM (Solar Photovoltaic (PV) Farm with associated infrastructure (ancillary equipment includes inverters, transformers, small embedded sub-stations and a grid connection building)) granted on 20/04/15 to allow for an additional 15 years of operation.	Scoped out of in-combination assessment. Existing development located 7.5km from the Humber Estuary SAC and Ramsar site. No construction activities proposed. Would not contribute to the operational air quality baseline against which the Proposed Development has been assessed.