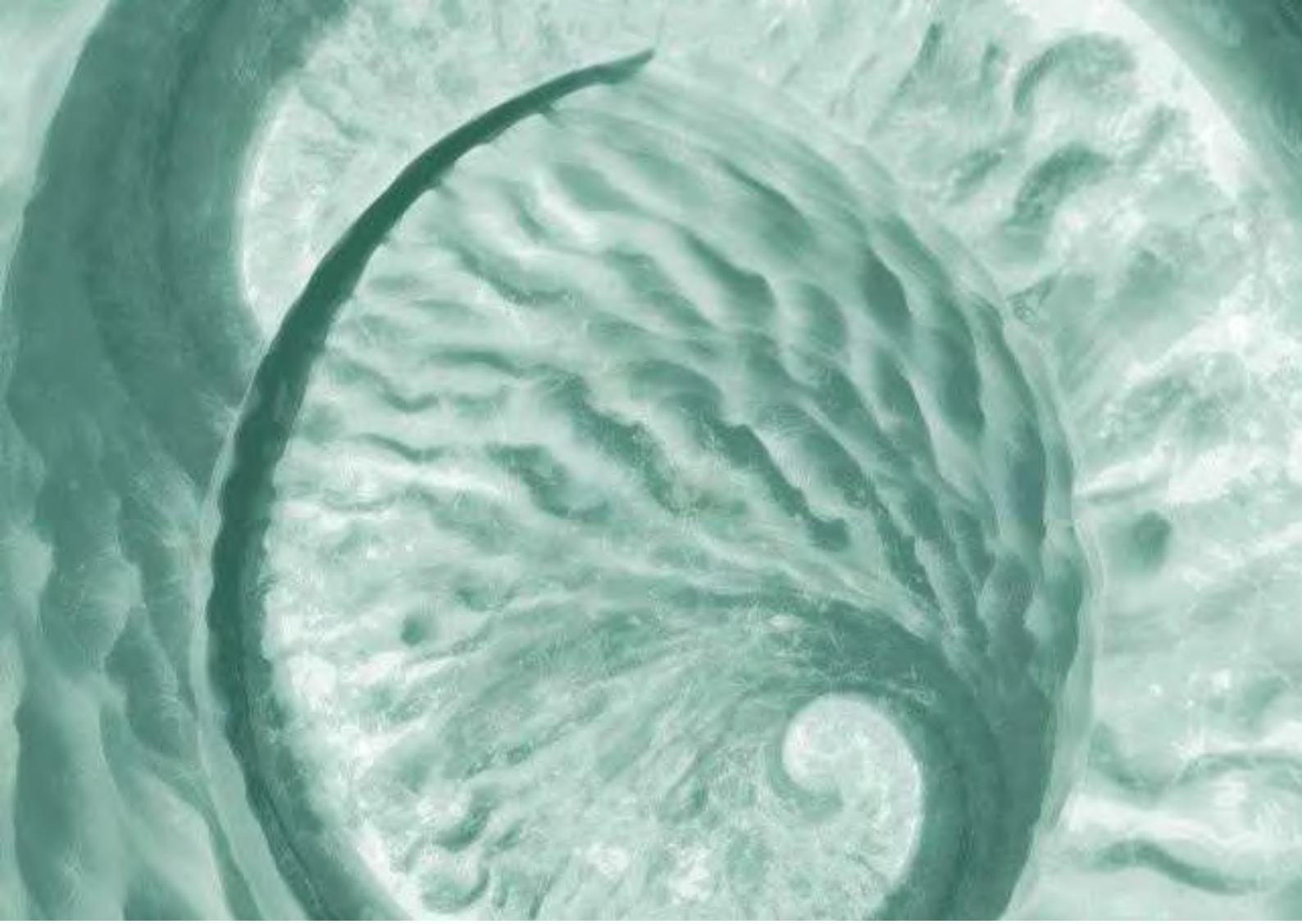

Environmental Impact Assessment Scoping Report

Aldbrough Hydrogen Pathfinder

24 March 2023

Project No.: 0653313

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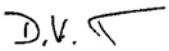
24 March 2023

Environmental Impact Assessment Scoping Report

Aldbrough Hydrogen Pathfinder



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Acronyms and Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AHP	Aldbrough Hydrogen Pathfinder
AHS	Aldbrough Hydrogen Storage
AIL	Abnormal Indivisible Load
ALARP	As Low As Reasonably Practicable
ALRA	Abnormal Load Route Assessment
APIS	Air Pollution Information System
AOD	Above Ordnance Datum
AONB	Areas of Outstanding Natural Beauty
AoS	Areas of Search
AQMA	Air Quality Management Area
BCT	Bat Conservation Trust
BEIS	Department for Business, Energy & Industrial Strategy
BGL	Below Ground Level
BGS	British Geological Society
BoCC	Birds of Conservation Concern
BNL	Basic Noise Level
BNG	Biodiversity Net Gain
BOP	Blowout Preventor
BS	British Standard
CCS or CCUS	Carbon Capture Usage and Storage
CDM	Construction (Design and Management)
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management

Abbreviation	Definition
CIfA	Chartered Institute for Archaeologists
CLG	Community Liaison Group
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COCP	Code of Construction Practice
COMAH	Control Of Major Accident Hazards
CoP	Code of Practice
COPA	Control of Pollution Act
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
CTMP	Construction Traffic Management Plan
DBA	Desk-Based Assessment
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
DMV	Deserted Medieval Village
DoW: CoP	Definition of Waste: Development Industry Code of Practice
EA	Environmental Assessment
EC	European Commission
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
EPC	Engineering Procurement and Construction
EPS	European Protected Species
ERM	Environmental Resources Management
ERYBAP	East Riding of Yorkshire Biodiversity Action Plan
ERYC	East Riding of Yorkshire Council
EA	Environment Agency
ES	Environmental Statement
EU	European Union
FEED	Front-end Engineering and Design
FRA	Flood Risk Assessment
GPP	General Pollution Plans
GCN	Great Crested Newt
GHG	Greenhouse Gas
GWP	Global Warming Potential
H_2	Hydrogen
HAA	Heavy Anti-Aircraft
HDPE	High Density Polyethylene
HER	Historic Environment Record
HGV	Heavy Goods Vehicles
HIA	Health Impact Assessment
HRA	Habitats Regulations Assessment
HSA	Hazardous Substances Authority
HSC	Hazardous Substances Consent
HSE	Health and Safety Executive

Abbreviation	Definition
HSWA	Health and Safety at Work etc. Act
IDB	Internal Drainage Board
IEF	Important Ecological Features
IEMA	Institute of Environmental Management and Assessment
IAQM	Institute of Air Quality Management
JNCC	Join Nature Conservation Committee
LCA	Landscape Character Area
LCRM	Land Contamination Risk Management
LCT	Landscape Character Types
LEP	Local Enterprise Partnership
LNR	Local Nature Reserve
LOAEL	Lowest Observed Adverse Effect Level
LoW	List of Waste
LPA	Local Planning Authority
LSOA	Lower-Level Super Output Area
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
MAGIC	Multi Agency Geographic Information for the Country
MAH	Major Accident Hazard
MA&D	Major Accidents and Disasters
MCM	Million Cubic Metres
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
MIT	Mechanical Integrity Testing
NCA	National Character Area
NERC	Natural Environment and Rural Communities
NH_3	Ammonia
NHLE	National Heritage List for England
NIA	Nature Improvement Areas
NNR	National Nature Reserves
NOAEL	No Observed Adverse Effect Level
NO_x	Oxides of Nitrogen
NO_2	Nitrogen Dioxide
NPPF	National Planning Policy Framework
NPS	National Policy Statements
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Project
NSRs	Noise Sensitive Receptors
NVZ	Nitrate Vulnerable Zone
OCGT	Open Cycle Gas Turbine
ONS	Office of National Statistics
OTMP	Operational Traffic Management Plan
OS	Ordnance Survey
PBDE	Polybrominated Diphenyl Ethers
PC	Process Contribution

Abbreviation	Definition
PEC	Predicted Environmental Concentration
PEDL	Petroleum Exploration and Development License
PM	Particulate Matter
PPE	Personal Protective Equipment
PPG	Planning Practice Guidance
PPG	Pollution Prevention Guidelines
PPGN	Planning Guidance on Noise
PRA	Preliminary Roost Assessment
PRoW	Public Right of Way
RIGS	Regionally Important Geological Sites
SAC	Special Area of Conservation
SCR	Selective Catalytic Reduction
SEA	Strategic Environmental Assessment
SINC	Sites of Importance for Nature Conservation
SFRA	Strategic Flood Risk Assessment
SOAEL	Significant Observed Adverse Effect Level
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPZ	Source Protection Zones
SRAM	Safety Report Assessment Manual
SSET	SSE Thermal
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
TA	Transport Assessment
UAEL	Unacceptable Adverse Effect Level
UK	United Kingdom
WFD	Water Framework Directive
WHO	World Health Organisation
WMP	Waste Management Plan
WRAP	Waste and Resources Action Programme
YNYERH	York, North Yorkshire, East Riding and Hull
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

1. NON-TECHNICAL SUMMARY

Introduction

SSE Thermal is proposing to construct and operate an electrolytic hydrogen production, storage, and energy generation facility, referred to as Aldbrough Hydrogen Pathfinder project. Located at SSE Thermal's Aldbrough Gas Storage site, the Aldbrough Hydrogen Pathfinder project is an important building block in the development of a thriving Humber hydrogen economy, underpinning the region's decarbonisation and supporting economic growth locally and nationally. An application for planning consent will be made to the East Riding of Yorkshire Council early Q3 2023.

Under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) the Aldbrough Hydrogen Pathfinder project is classed as a Schedule 2 development. SSE Thermal will undertake an Environmental Impact Assessment (EIA) without the need for screening and the planning application will in turn be accompanied by an Environmental Statement.

Scoping, leading to the production of a Scoping Report, is a key step in the EIA process, whereby a Scoping Opinion is sought from East Riding of Yorkshire Council and its statutory consultees (such as Natural England and the Environment Agency). The Scoping Opinion sets the terms of reference for completing the EIA and the information to be provided in the Environmental Statement.

This section is the Non-Technical Summary to the Scoping Report.

Project Overview

The Aldbrough Hydrogen Pathfinder project will integrate electrolytic hydrogen production, salt cavern storage of hydrogen, and low carbon hydrogen power by way of an Open Cycle Gas Turbine (OCGT). Electrolytic hydrogen will be produced using green power sourced from the grid through Renewable Power Purchase Agreements, in compliance with the Low Carbon Hydrogen Standard, and will power an electrolyser to split borehole water into hydrogen and oxygen. Storage will be secured by converting one of Aldbrough's existing natural gas storage caverns (Aldbrough 1) to store hydrogen; oxygen will be vented to atmosphere. The produced and stored hydrogen will be distributed via a dedicated above ground pipeline to the OCGT which will operate on up to 100% hydrogen and will export power back to the grid during times of low renewable power availability. The Aldbrough Hydrogen Pathfinder project will support the evidence base for wider deployment of flexible hydrogen power in the UK's net zero journey and will be a major enabler of the Humber Cluster's decarbonisation ambitions. The project will unite hydrogen production, storage, and power generation in one location by the middle of this decade and will showcase how hydrogen can provide home-grown security of supply while powering the UK to net zero.

As stated above, the Aldbrough Hydrogen Pathfinder project will require use of the Aldbrough 1 storage cavern. The cavern is currently filled with natural gas and as such the cavern will be rewatered to remove the natural gas, then refilled with hydrogen, displacing the water/brine. There are three options for disposal of the water resulting from the filling of the cavity with hydrogen:

1. Discharge of the water to sea – utilising an existing but decommissioned pipe (onshore and offshore) and diffuser running east from the Aldbrough Gas Storage site;
2. Rewatering of ALD4z cavern and its subsequent decommissioning; or
3. Tankering of the water off site with disposal at the nearby licenced SSE Atwick site or alternative disposal site.

The marine aspect of this proposal (option 1 above) does not fall within the jurisdiction of this Scoping Report, rather it is subject to a separate EIA process under The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). The marine planning and licensing functions apply from the mean high-water mark. Any work extending to the mean low water mark is covered by this onshore Scoping Report.

The Site Setting

The Aldbrough Hydrogen Pathfinder project site is primarily located within the Aldbrough Gas Storage facility, which commenced operation in June 2011. The last of the nine caverns entered commercial operation in November 2012. The facility, which is a joint venture between SSE Thermal and Equinor, has the capacity to store around 330 million cubic metres (mcm) of gas. A below-ground brine discharge pipe extends east from the Aldbrough Gas Storage facility to the North Sea, and this is included within the scoping boundary. An area to the north of the pipe and the coast has been identified as a temporary construction area. A second construction area has been identified 100m south of the site. Access to the site is via the existing access from the B1242 Aldbrough Road.

The Aldbrough Hydrogen Pathfinder project site is set predominantly within an existing brownfield site and offers several environmental benefits, including:

- developing a brownfield site allocated in planning terms for this type of development;
- absence of on-site sensitive ecological receptors;
- very few community receptors within the local area;
- the site is screened by an earth bund and mature vegetation;
- good transport access; and
- opportunity to share utilities with existing on-site infrastructure.

Key Issues for the EIA

The full list of EIA topics required to be covered by the EIA Regulations has been considered by a team of EIA specialists. The main aims of the exercise are to establish the extent of existing environmental and socioeconomic baseline information, further data required (e.g. through surveys), identify those features likely to be most sensitive to impacts of the Aldbrough Hydrogen Pathfinder project and plan how the impact assessment is to be approached in terms of the methodologies and assessment criteria to be applied.

Key issues for each topic are summarised in **Table 0-1** below, noting this is a summary more detailed information contained in the body of the Scoping Report.

Table 0-1 Key Issues for the EIA by Topic

TOPIC	KEY ISSUES
Ground conditions and contamination	■ Disturbance/mobilisation of potentially contaminated soils during construction. ■ Accidental spillages or leaks of contaminative material during construction. ■ Mobilisation of contamination via dewatering of excavations, drainage flows etc.
Water resources and flood risk	■ Accidental chemical / fuel spillage, fresh concrete, foul water, and the mobilisation of construction site sediments into watercourses bounding the site. Abstraction of groundwater to support hydrogen production.
Noise and vibration	■ Noise at residential receptors (and possibly ecological receptors) from on-site construction activities, particularly percussive piling, and demolition of any existing structures. ■ Increase in road traffic due to materials and plant delivery / removal. ■ Increase in road traffic due to potential tankering of brine discharge to disposal facilities. ■ Vibration impacts on close by industrial premises (residential too distant to be affected). ■ Operational noise from fixed plant and emergency maintenance flaring.
Air quality and climate change	■ Construction dust impacts (mainly close by industrial premises). ■ Operational emissions from combustions sources on site and emergency flare.
Traffic and transport	■ Construction traffic (including abnormal loads) impacts on users of the local road network. ■ Potential noise and air quality impacts of construction traffic.

	■ Potential tankering of brine off site.
Ecology and nature conservation	■ Construction activity disturbance, especially for birds using the nearby protected areas. ■ Effects of operational emissions to air on nearby protected areas.
Landscape and visual amenity	■ Construction impacts from large plant and cranes. ■ Visual impacts on local residents and recreational users from taller/bulkier elements of the completed development, noting its context within a brownfield site with existing screening.
Archaeology and cultural heritage	■ No likely impacts on buried cultural assets during construction although possible effects along the new brine outfall pipe (if required) to the coast. ■ Possible effects on the setting of off-site heritage features.
Socioeconomic characteristics	■ Potential general disturbance during the construction phase. ■ The positive effects of inward investment, employment etc. during construction and operation.
Health	■ Effects on health and wellbeing of local communities from potentially negative environmental changes alongside the positive economic and low-carbon energy aspects of the Proposed Development.
Major accidents	■ Potential hazards to people and neighbouring assets in the event of an incident during operation, noting that the AHP project must meet stringent safety requirements in design and operation and demonstrate it will do so to the relevant authorities before it can commence commissioning and operating activities.
Waste management	■ Generation of solid wastes during construction that might include contaminated material. ■ Generation of solid wastes during operation. ■ Generation of liquid waste streams during construction and operation.

2. INTRODUCTION

2.1 Purpose of this Report

This Scoping Report, which includes a Request for Scoping Opinion, has been prepared on behalf of SSE Thermal (SSET), the Applicant. It is part of the process of undertaking an Environmental Impact Assessment (EIA) of the Applicant's proposal to construct and operate electrolytic hydrogen production, salt cavern storage, and low carbon hydrogen power generation facility, referred to as Aldbrough Hydrogen Pathfinder (AHP) project or 'the Proposed Development' on land at SSE's Aldbrough Gas Storage site (referred to as the Site), located in the East Riding of Yorkshire.

It is considered that under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) the Proposed Development falls within the scope of Schedule 2 of the regulations. Further details on this are provided in Section 3.

2.2 Request for Scoping Opinion

This report is provided to East Riding of Yorkshire Council (ERYC) under Regulation 15 of the 2017 EIA Regulations. This is in support of a request by ERM on behalf of the Applicant for a 'Scoping Opinion' regarding the information to be provided within the Environmental Statement (ES) that will accompany the planning application.

The EIA will be undertaken and prepared with due regard to the requirements of Schedule 4 of the 2017 EIA Regulations. The ES will include an assessment of the predicted effects on the environment and people of the Proposed Development, focussing on the effects that have the potential to be significant. The content of the ES, as well as the overall approach to the EIA, will reflect other requirements of the 2017 EIA Regulations, as well as widely recognised good practice in EIA, including public consultation.

2.3 Project Overview

The Proposed Development will integrate electrolytic hydrogen production (c.35MWe), salt cavern storage (c.20GWh), and low carbon hydrogen power production by way of an Open Cycle Gas Turbine (OCGT) (Up to 50MWe (net) capacity).

Electrolytic hydrogen will be produced from a Proton Exchange Membrane Electrolyser using power sourced from the grid through Renewable Power Purchase Agreements, in compliance with the Low Carbon Hydrogen Standard, and water abstracted from an existing onsite borehole. Salt cavern storage will be secured by converting one of Aldbrough's existing natural gas storage caverns (Aldbrough 1). The produced and stored hydrogen will be distributed via a dedicated above ground pipeline to the OCGT which will operate on up to 100% hydrogen and will export power back to the grid in times of low renewable power availability. The oxygen resulting from the electrolysis will be vented to atmosphere. The feasibility of opportunities to capture the oxygen for use in other applications (e.g for hospitals) will be assessed and considered.

Located at SSET's Aldbrough Gas Storage site, the AHP project is an important building block in the development of a thriving Humber hydrogen economy, underpinning the region's decarbonisation and supporting economic growth locally and nationally. AHP will help chart a path for electrolytic hydrogen production in the Humber, uniting production, storage and offtake in one location by the middle of this decade. It will showcase how electrolytic hydrogen can provide home-grown security of supply while powering the UK to net zero. This first-of-a-kind project will support the evidence base for wider deployment of flexible power generation in the UK's net zero journey.

With the added expertise of Siemens Energy and specialist engineering consultants, AHP will secure early electrolytic hydrogen production capacity and prove an integrated concept to add vital flexibility and security to the system. There are clear advantages to running a gas turbine on hydrogen, from the reduction in exhaust CO_2 emissions from combustion to diversification from natural gas supply.

The Proposed Development will comprise the construction of facilities for the production, storage and retrieval of green hydrogen and its conversion into green electricity by an open cycle gas turbine. This will require the use of the Aldbrough 1 storage cavern. The cavern is currently filled with natural gas and as such the cavern will need to be rewatered to remove the natural gas, then filled with hydrogen which will displace the water/brine. There are three options for disposal of the water resulting from these operations:

1. Discharge of the water to sea - utilising an existing but decommissioned pipe (onshore and offshore) and diffuser running east from the Aldbrough Gas Storage site;
2. Rewatering of ALD4z cavern and its subsequent decommissioning; or
3. Tankering of the water off site with disposal at the nearby licenced SSE Atwick site or alternative disposal site.

The marine aspect of this proposal (option 1 above) does not fall within the jurisdiction of this Scoping Report, rather it is subject to a separate EIA process under The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). The marine planning and licensing functions apply from the mean high-water mark. Any work extending to the mean low water mark is covered by this onshore Scoping Report.

2.4 Consultation to Date

The AHP project team are facilitating project socialisation (introductory engagement). This engagement consists of introductory one-on-one engagement with East Riding of Yorkshire Council (ERYC) and selected other Statutory Stakeholders to build relationships, socialise the project, understand key concerns and hear any recommendations regarding further engagement activity.

As part of the upcoming Project Socialisation phase, the following tasks will be completed:

- Engagement with ERYC and their planning department;
- Initial meetings with statutory bodies and key stakeholders;
- Presentation of scoping outputs in series of workshops with key stakeholders;
- Updated project website for general project and contact information; and
- Newsletter distribution to localised consultation area informing the community of the project.
- A second phase of consultation is proposed including a single statutory and non-statutory consultation event.

2.5 The Applicant and Study Team (SSE Thermal; EIA Study Team; Other Contributors)

SSE Thermal is a leading provider of flexible thermal energy. SSET operates an industry-leading fleet of flexible generation and energy storage assets including the Aldbrough and Atwick gas storage facilities. SSET is committed to reducing the carbon intensity of the electricity it generates by 80% by 2030, from a 2018 baseline.

Environmental Resources Management Ltd (ERM) is leading the EIA and providing technical advice and support across the range of technical studies. ERM is supported by its subsidiary companies (Arcus and ESC) providing local technical knowledge and local resources across environmental and safety studies.

2.6 Report Content and Structure

The remainder of the Scoping Report contains the following:

- Section 3 provides an overview of the Project;

- Section 4 gives an outline of relevant policy, standards and guidance;
- Section 5 discusses alternatives to the Proposed Development;
- Section 6 describes the overall approach to the EIA;
- Section 7 Geology and Ground Conditions;
- Section 8 Water Resources and Flood Risk;
- Section 9 Noise and Vibration;
- Section 10 Air Quality;
- Section 11 Traffic and Transport;
- Section 12 Ecology and Nature Conservation;
- Section 13 Landscape and Visual Amenity;
- Section 14 Historic Environment;
- Section 15 Socioeconomic Characteristics;
- Section 16 Population and Human Health;
- Section 17 Major Accidents and Disasters;
- Section 18 Waste Management;
- Section 19 Climate Change and Greenhouse Gas Emissions;
- Section 20 Cumulative Effects; and
- Section 21 Summary and Next Steps.

3. PROJECT DESCRIPTION

3.1 Introduction

This section provides an overview of the Proposed Development. It sets out the design and main components of:

- Facilities for the production, storage and retrieval of electrolytic hydrogen and its conversion into green electricity by an OCGT;
- Two temporary construction areas; and
- Refurbishment of an existing brine discharge pipe and associated infrastructure and discharge to the marine environment, noting that this Scoping Report only includes an onshore pipe for this development. Offshore works are subject to a separate application.

Key activities include:

- The rewatering and subsequent debrining of Aldbrough 1 salt cavern during the commissioning phase.
- Electrolytic hydrogen production from a Proton Exchange Membrane Electrolyser and use of cavern Aldbrough 1 for the storage and retrieval of hydrogen during the operational phase;
- Operation of the OCGT, and associated facilities for the generation of electricity during the operational phase;
- Decommissioning of the project at the end of its operational life.

In addition, the following alternative brine discharge activities may be required during the commissioning phase if the refurbishment of existing marine discharge infrastructure is not feasible:

- Rewatering of ALD4z storage cavern using up to 60,000 m^3 of debrining water from the project commissioning; or
- Tankering off site of 60,000 m^3 of debrining water to a licenced waste disposal facility.

During the operational phase, the electrolyser will require the use of demineralised water which will be supplied from the existing licensed Aldbrough borehole water supply. The electrolyser reject water produced during the treatment process (of up to 4-8 m^3 per hour) will be treated prior to discharge. Treatment and discharge options of this reject water are being explored and further details will be provided in the ES.

At this early stage in the Proposed Development, the Project Description is indicative and the ‘envelope’ has been designed to include sufficient flexibility to accommodate further refinement during detailed design.

This section therefore sets out a series of options and/or parameters for which maximum values are used to constitute a realistic Maximum Design Scenario (MDS) for the Proposed Development.

The Project Description will be expanded as the Proposed Development develops through the design, consultation, and EIA processes.

3.2 Design Envelope Approach

The Design Envelope approach is widely recognised and its applicability to EIAs is set out in current guidance on applying the Rochdale Envelope to EIAs[1].

Throughout the Scoping Report and subsequent EIA, the Design Envelope (otherwise known as the "Rochdale Envelope"") approach has been (and will continue to be) taken to allow meaningful

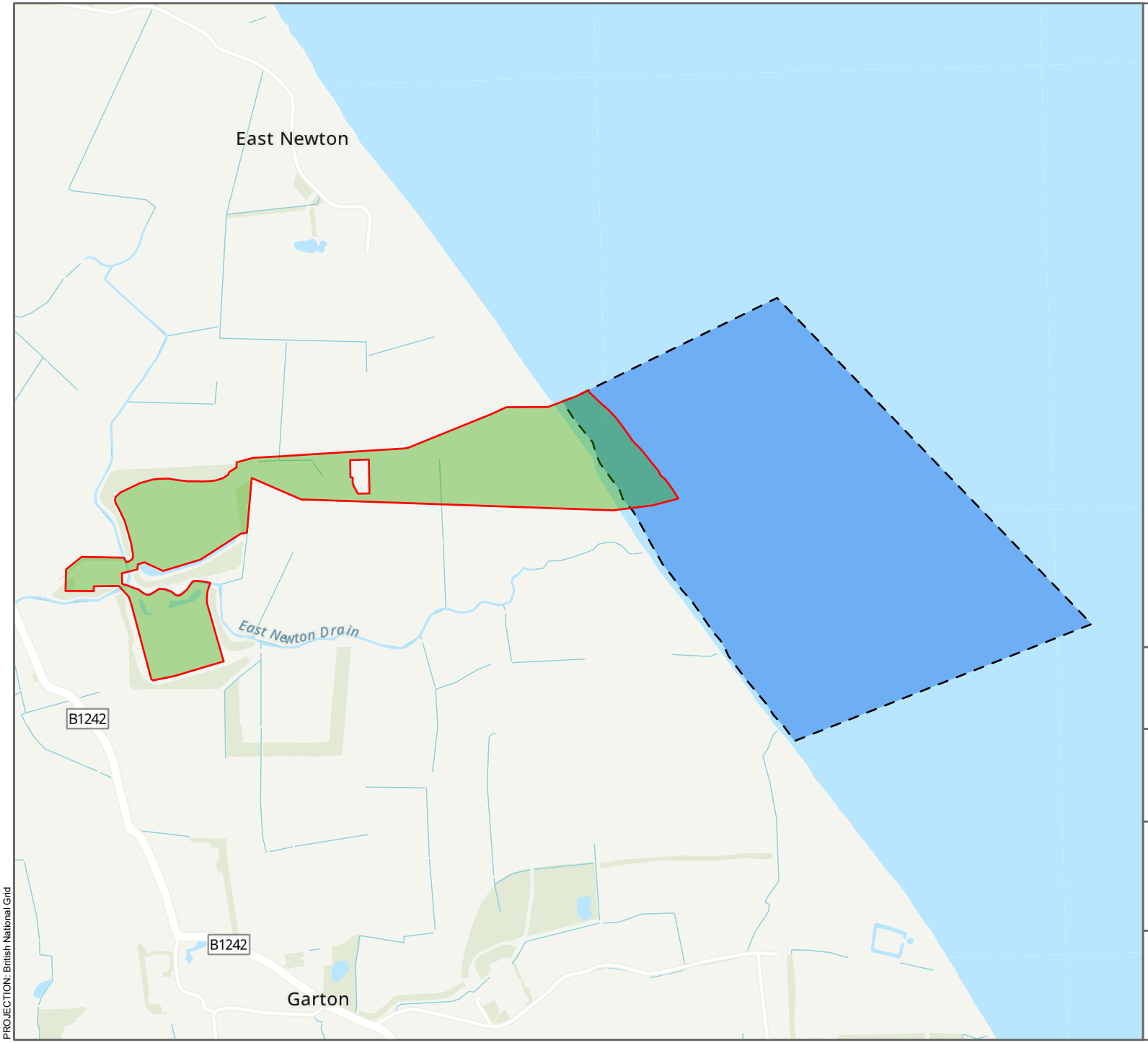
[1] IEMA (2013) *EIA coordinators and the Rochdale Envelope - IEMA*. Available online: https://www.iema.net/articles/eia-coordinators-and-the-rochdale-envelope

assessments of the Proposed Development to proceed, whilst still allowing reasonable flexibility for future project design decisions.

The Proposed Development design and the application boundary will also be further refined and evolve through the EIA process.

3.3 The Scoping Boundary

Figure 3.1 illustrates the Scoping Boundary that has been used to inform this Scoping Report. The Scoping Boundary is defined as the area within which it is currently understood the Proposed Development will be physically located, including the temporary work areas. The Scoping Boundary should not be taken as an indication of the extent of the eventual application boundary as it includes flexibility for decisions yet to be made on aspects of siting and the potential need for discharge to the marine environment.



Site Boundary

Onshore

Offshore

0 100 200 300 400 500

Metres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: DN
PROJECT: 0653313	CHECKED: SE
DATE: 07/03/2023	APPROVED: RB

Figure 3.1
Scoping Boundary

ERM

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0653313 - Project Accelerator\Maps\0653313 - Project Accelerator - A01.aprx\0653313 - Pathfinder - Scoping Boundary - A01

3.4 Project Infrastructure Overview

This section of the report provides an overview of different elements of the Proposed Development.

3.4.1 Conversion of Aldbrough 1 Cavern

The first step in the conversion process will be the rewatering of Aldbrough 1. Aldbrough 1 is currently an operational natural gas storage cavern. The cavern will be rewatered by displacing the existing natural gas contents with brackish water. The brackish water source will be the existing site borehole which operates under an existing abstraction licence. The displaced natural gas will be exported to the process plant manifold via existing plant systems before being temporarily stored in one of the other operational caverns at Aldbrough prior to export to the natural gas grid. Aldbrough 1 will be rewatered using a similar well design as has been developed for the other SSE caverns. A workover rig similar to what has been on site for previous well recompletions will be required to complete these works. The workover rig will be operated on 24/7 basis throughout the recompletion process.

For the transition from natural gas to hydrogen the well at Aldbrough 1 will be relined and recompleted. This is likely to include the following activities:

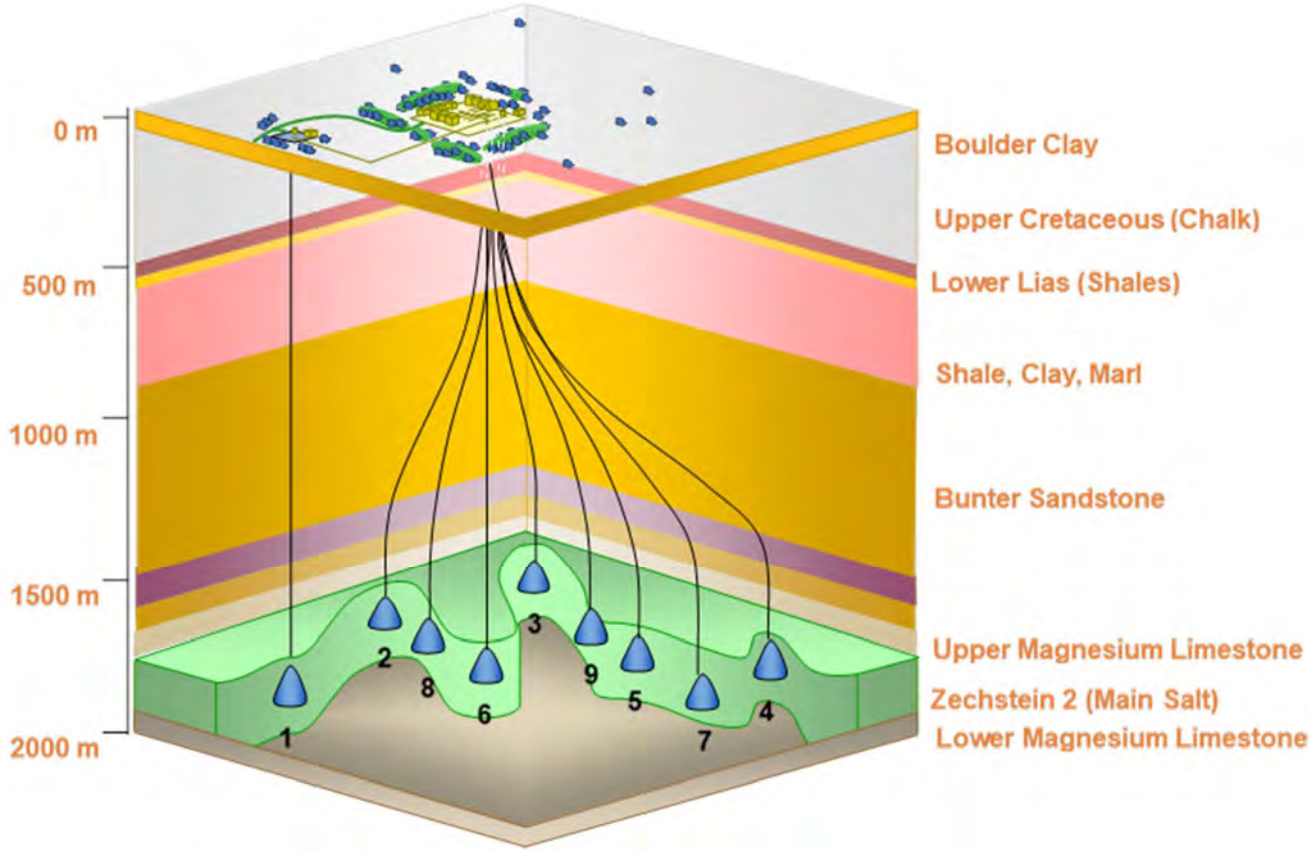
- Aldbrough 1 pressure reduction to Pmin (pressure minimum)
- Installation of rewatering equipment
- Rewatering of cavern
- Removal of existing natural gas completion from well
- Mechanical integrity testing (MIT) hydrogen test of existing casing shoe
- Reline with hydrogen suitable casing and contingency section milling and MIT
- Installation of hydrogen suitable completion including production tree
- MIT hydrogen test of new completion
- Installation of dewatering equipment
- Injection of hydrogen and debrining cavern until anticipated volume and removal of dewatering equipment

Following successful rewatering, the contents of the cavern – up to 60,000 m^3 of brine will be displaced with hydrogen produced from the electrolyser over a period of approximately 4 months. It is intended that the water will be discharged offshore utilising the existing and refurbished marine infrastructure. Further investigation is required to identify the current status of the infrastructure and the overall feasibility of marine discharge. If marine discharge is not feasible, contingency alternative approaches have been identified (detailed in Section 5).

3.4.2 Cavity Geology

From two borehole records on site, it is possible to generally confirm the British Geological Survey (BGS) viewer mapped geology, recording Glacial Till deposits comprising a mixture of boulder clay and gravel and sand layers, overlying chalk bedrock. **Figure 3-2** illustrates the geology of the Aldbrough 1 cavern which is approximately 1.8 km in depth. In addition, the BGS records an area of Alluvium overlying the Glacial Till in a band under the central part of the existing SSE Hornsea site. The Alluvium may extend to some of the Proposed Development area.

Figure 3-2 Cavity Geology



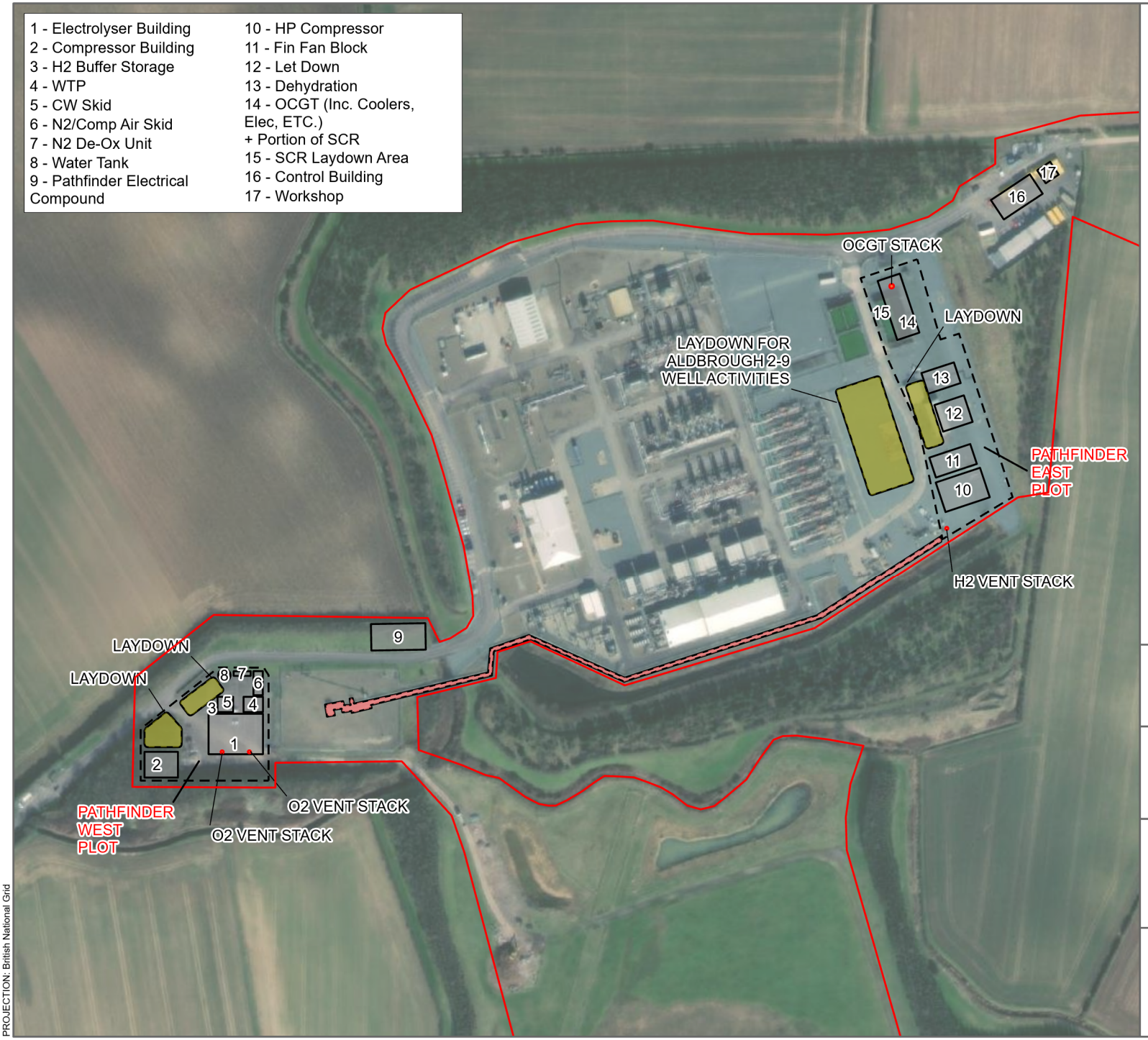
3.4.3 Surface Layout and Design

Permanent above ground works will be constructed on previously developed land at the Aldbrough Gas Storage site (see **Figure 3-2**). There are two areas identified for potential siting of equipment:

- the area immediately west of the Aldbrough 1 wellhead that is currently a car park; and
- the area to the east of wellheads 2-9 that currently houses a warehouse and obsolete blast proof operations cabin.

The western plot will house the electrolysers and the plant associated with them, including water treatment plant, demineralised water storage, low pressure compression, hydrogen buffer vessel (for storage of hydrogen produced by electrolysers while the compression plant is starting up and for the collection of hydrogen vented from other equipment items) and other utilities such as nitrogen and compressed air. The area will also host an electrical compound for the AHP project and a vehicle holding area that can be used for rig transport etc.

The eastern plot will house the higher pressure compression plant, the cooling system, the dehydration and letdown plant and the OCGT. This will allow the positioning of the majority of the high pressure, high noise equipment away from the main road and Aldbrough village, and the adjacent farmland will be screened with the existing landscaping and earth berm walls. The control room and workshop will also be in this location.



Onshore Site Boundary
Laydown Area
HP Pipeline Corridor

0 50 100 150
Metres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: DN
PROJECT: 0653313	CHECKED: SE
DATE: 03/03/2023	APPROVED: RB

Figure 3.3
Site Layout

ERM

PROJECTION: British National Grid

3.5 Construction

The construction of the Proposed Development will be split into the main components of:

- Conversion of Aldbrough 1 Cavern (Section 2.4.1);
- Construction of permanent above ground works; and
- Marine Infrastructure.

Construction is scheduled to start in 2024 and is anticipated to last 36 months.

3.5.1 Construction of Permanent Above Ground Works

The construction activities required for permanent above ground works will include the following:

- Site mobilisation;
- Demolition of existing redundant equipment;
- Ground works and site preparation;
- Civil construction works;
- Erection of buildings and structures;
- Equipment installation; and
- Commissioning

The construction will be managed by a temporary construction compound located to the south of Aldbrough 1. An area to the north of the pipe and the coast has been identified as an additional temporary construction area.

Access to the site is via the existing access from the B1242 Aldbrough Road.

3.5.2 Marine Infrastructure

3.5.2.1 Re-lining of the existing HDPE Pipe

If following the inspection of the existing high density polyethylene (HDPE) pipe it is determined that the pipe needs to be re-lined, the re-lining will take place on the beach between the mean high-water mark and mean low-water mark. The exact method for the relining of the HDPE pipe has yet to be determined but is expected to comprise:

- Excavation of the existing HDPE pipe on the beach located next to the clifftop compound using conventional excavation methods i.e., a mobile excavator. The working area is expected to be approximately 750 m^2.
- The excavated materials will be placed to the side of the pit whilst the re-lining of the pipe is undertaken and will be reused to backfill the pit once works are complete.
- Cutting and retrieval of the cut end of the exiting HDPE pipe.
- Re-lining of the existing HDPE pipe with a smaller diameter pipe which will be pushed through the existing pipe out to the end of pipe which is c. 600 m from shore.

Following relining of the HDPE pipe, the trench will be backfilled with the excavated materials and the site will be fully restored. The works will include full burial of the section of HDPE pipe currently exposed on the beach.

3.5.2.2 Re-burial of the existing HDPE Pipe

The existing HDPE pipes are currently exposed on the beach and as part of the proposed works the exposed pipes will be buried. A small pit will be excavated around the existing HDPE pipe in the area

including the cliff face where the pipes are currently exposed, the pipe will be buried to a suitable depth and covered with the excavated material.

The access to the beach will be via an access ramp constructed from the cliff top to the beach. Design work is ongoing and the exact construction area will be confirmed in the ES.

3.6 Operation

3.6.1 Operational Water Production

Operation of the electrolyser will require the use of demineralised water. Water will be supplied from the existing licensed Aldbrough borehole water supply. The borehole will provide a brackish[2] water supply and as such will require demineralisation. The existing town's water supply is constrained on the Aldbrough Gas Storage site and is therefore not considered as a potential source.

Pre-treatment of the borehole water will consist of dechlorination, pH adjustment and clarification, with these steps producing potable water. In consequence the treated water can be taken to supply both the electrolyser and be used as a source of water for additional uses such as workshops, control room and welfare facilities. The water, despite being potable, will not be used for human consumption.

The reject water from the water treatment plant (of up to 4-8 m^3 per hour) may be further treated prior to discharge. Treatment and discharge options of this reject water are being considered and further details will be provided in the ES.

3.6.2 Operational Hydrogen Production and Combustion

The electrolysers will use demineralised water to produce hydrogen and oxygen, the latter of which will be vented to atmosphere. The hydrogen produced in the electrolyser is expected to be saturated with water and contain traces of oxygen, therefore treatment is required to improve the purity of hydrogen and remove water prior to compression. The wet hydrogen gas will be passed through a separator vessel, to remove any water in the stream and a deoxidiser vessel which will remove any oxygen from the gas by catalytic oxidation with hydrogen. The hydrogen will then be compressed and injected into the underground cavern.

The Proposed Development will be capable of delivering up to 4000 kg/h of hydrogen from the caverns. Hydrogen removed from the cavern will need to be reduced in pressure and have any potential contaminants including water removed prior to combustion.

The hydrogen will then be fed into the OCGT, which will be capable of operating on up to 100% hydrogen and will generate up to 50 MWe (gross power output) for export to grid. The OCGT will also be capable of operating on up to 100% natural gas and varying blends of natural gas and hydrogen, therefore a natural gas supply of up to 10,000 kg/h will be provided. It is envisaged that this will be taken from the existing plant gas pipeline reception facilities to the north of the existing control building and workshop.

Given the higher combustion temperature of hydrogen compared to natural gas, higher NOx concentrations in the combustion products are anticipated during combustion in the OCGT. In consequence, it is expected that additional mitigation (in the form of combustion temperature manipulation) will be embedded in the project to control NOx emissions. The potential for selective catalytic reduction (SCR) may also be considered, if required.

Venting and/or flaring of hydrogen will be required to support events such as periodic depressurisation of hydrogen systems, to allow a safe shutdown for routine and emergency situations, as well as to prevent the accumulation of a hazardous atmosphere within the plant. The application of venting and/or flaring will be made based on technical, health, safety and environmental reasoning, including guidance published by Government bodies. An emissions reduction plan will be developed

[2] Brackish water is water occurring in a natural environment that has more salinity than freshwater, but not as much as seawater. It typically occurs in areas such as estuary's where seawater and freshwater mix.

to quantify and minimise the emissions as far as is reasonably practicable, as well as document potential options for further reduction.

3.7 Decommissioning

It is anticipated that the Proposed Development will be operational for 25 years. At the end of the operational phase, it is expected that both the surface and subsurface plant will have some residual life. An investment decision will be made, based on market conditions, to determine if operation of the surface and/or subsurface infrastructure (including the well and cavern) will be extended.

If, at the end of the operational phase, the decision is taken to decommission the surface plant, the above ground structures – Electrolyser, OCGT and the blowout preventor (BOP) will be removed from site, and the site restored. The surface infrastructure associated with the well will only be removed following the wells decommissioning.

At the end of the operational phase, if the decision is taken to decommission the subsurface plant then the following steps will be taken in line with the SSET's existing cavern and well decommissioning plan. It takes approximately 6 years to decommission a well and cavern due to a 5-year suspension monitoring period prior to abandonment. The main operations required to decommission the cavern and well are as follows:

- Cavern rewatered;
- Monitoring period;
- Removal of Rewatering Tubing and Completion (Well decommissioning activities can only proceed once the suspension of the well and cavern has been deemed successful and the cavern is stable);
- Set Cement Plugs and Cut Casing at Surface; and
- Remove surface infrastructure associated with the wells.

3.8 Employment

During construction and operation there will be inward investment to the region, with employment and expenditure in the local economy during construction and job creation during construction and operation. It is anticipated that the Proposed Development will create approximately 500 direct and 150 indirect jobs throughout construction and operation. There will be economic benefits arising from direct and indirect expenditure associated with the AHP project, for example through placing local orders for goods and services and maintenance.

4. PLANNING AND POLICY CONTEXT

4.1 Introduction

Sustainable development is the core principle underpinning planning and the core consideration of planning applications. It makes a positive difference to people's lives and helps deliver homes, jobs, and better opportunities for all, whilst protecting and enhancing the natural and historic environment.

National, regional, and local policies are relevant to the consideration of the Proposed Development. At all levels, policies are designed to protect, and where possible, appropriately enhance the environment. In undertaking an EIA, it is therefore important to identify those policies which are particularly relevant to the Proposed Development. This section of the Scoping Report aims to identify the relevant policies allowing policy context to be clear and provide the context for the Scoping Opinion.

The policies relevant to the Proposed Development are summarised based on a review of the following documents.

4.1.1 National Policy

- National Planning Policy Framework (NPPF)

4.1.2 Joint/Regional Planning Policy

- Hull and East Riding Joint Planning Statement (March 2014)
- York, North Yorkshire, East Riding and Hull – Spatial Framework: A vision for growth

4.1.3 Local Policy

- East Riding of Yorkshire: East Riding Local Plan Strategy Document (adopted April 2016), Allocations Document (adopted July 2016)

4.1.4 Emerging Policy

- East Riding of Yorkshire: Draft Local Plan update, Draft Flood Risk Sequential and Exception Test SPD

A Planning Statement will accompany the planning application for the Proposed Development. The Planning Statement will contain a detailed assessment of the key policies related to the Proposed Development and identify where the project complies with the requirements stipulated in the policies or contributes to the overarching objectives stated within the local development plan. The planning statement will demonstrate how the Proposed Development has met the criteria set out in the relevant policies and provide full details on how it has assessed all planning and environmental matters that are of importance to the outcome of the AHP project.

4.2 Legislative Context

The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (Statutory Instruments 2017 No. 571) came into force on 16th May 2017 (the EIA Regulations).

The Regulations state the requirements for EIA for major projects. The EIA Regulations apply to every 'EIA Application' lodged with a Planning Authority on or after 16th May 2017. The Regulations state that a relevant Planning Authority, or the Secretary of State, or a Planning Inspector, will not grant planning permission or subsequent consent pursuant to an application to which this regulation applies unless the Authority has first taken the environmental information into consideration, and state in their decision that they have done so.

An 'EIA application' means an application for planning permission for 'EIA development'; 'EIA development' means development which is either:

a. Schedule 1 development; or

b. Schedule 2 development likely to have significant effects on the environment by virtue of factors such as its nature, size, or location;

'Schedule 2 development' means development, other than exempt development, of a description mentioned in Column 1 of the table in Schedule 2 where:

a. any part of that development is to be carried out in a sensitive area; or

b. any applicable threshold or criterion in the corresponding part of Column 2 of that table is respectively exceeded or met in relation to that development;

Under the 2017 EIA Regulations, the Proposed Development falls within Schedule 2 Category 3 'Energy Industry' sections:

a. Industrial installations for the production of electricity, steam and hot water (unless included in Schedule 1);

b. Surface storage of natural gas; and

c. Underground storage of combustible gases.

The NPPF was issued in February 2019 and sets out the Government's Planning Policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other developments may be produced.

The policies contained within the NPPF are expanded upon and supported by the 'Planning Practice Guidance' (Ministry of Housing, Communities and Local Government, 2019b).

The NPPF sets out the Government's planning policies for England and how these are to be applied. It is a material consideration in planning decisions.

Sections of the NPPF that are of particular relevance to the scope of the EIA include:

- 2 - Achieving sustainable development;
- 6 - Building a strong, competitive economy;
- 11 - Making effective use of land;
- 12 - Achieving well designed places;
- 14 - Meeting the challenge of climate change, flooding, and coastal change;
- 15 - Conserving and enhancing the natural environment; and
- 16 - Conserving and enhancing the historic environment.

In respect of climate change, Paragraph 7 is of relevance, by linking the purpose of the planning system to the United Nations 17 Global Goals for Sustainable Development in the period to 2030, which include 'climate action'.

Paragraph 11 then places climate mitigation and adaptation at the heart of plan-making: "*plans should promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects.*"

Paragraph 153 requires local planning authorities to take a proactive approach to mitigating and adapting to climate change, and for the first time refers to the provisions and objectives of the Climate Change Act 2008.

Paragraphs 81-83 detail the planning policy and decision making in relation to supporting a prosperous, strong, and diverse economy. It further states that planning policies and decisions should recognise and address the specific locational requirements of different sectors.

Section 15 and paragraph 174 provide the national guidance on how policies and developments should contribute to and enhance the natural environment. Further stating that "*development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate*."

4.3 Joint/Regional Policy

The site considered as a part of this Scoping Report is an existing SSE operated brownfield gas storage site located on the outskirts of Aldbrough, which falls under the jurisdiction of East Riding of Yorkshire Council. Due to the site being in close proximity to other councils some policies have been made in conjunction with neighbouring councils.

4.3.1 Hull and East Riding Joint Planning Statement (March 2014)

Hull City Council and East Riding of Yorkshire Council, through the development of their respective Local Plans, have engaged with each other constructively and on an ongoing basis. This was formalised through the preparation of a Joint Planning Statement, which was agreed by the Cabinet of each Council and identified their cross-boundary strategic priorities that are of relevance for both authorities. It is also reflected in joint working arrangements that have been established to manage the preparation of their respective Local Plans and the Joint Minerals and Waste Plans for the combined authority area.

The key strategic agreements between the authorities for the combined areas relate to the:

- regeneration of Hull, improving its role, performance and environmental quality, and creation of strong and sustainable communities across the East Riding;
- potential of the Humber Ports is realised alongside the growth of the renewable and low carbon energy sector; and
- integrity of the internationally important environmental and biodiversity designations around the Humber Estuary has been protected.

4.3.2 York, North Yorkshire, East Riding and Hull – Spatial Framework: A vision for growth

This framework document covers the areas of York, North Yorkshire, East Riding and Hull (YNYERH) and focuses on the period 2035 to 2050. It looks beyond the time frame of existing and emerging local plans, which set the planning approach across the area for the next 15-20 years.

The Spatial Framework is a non-statutory document, prepared to shape and influence the next generation of plans, strategies, and investment programmes. Local Plans will continue to form the statutory development plan for each Local Planning Authority.

The purpose of the Spatial Framework is to promote a long term and co-ordinated approach to growth and infrastructure planning in the YNYERH area and therefore, whilst not a statutory document, it is considered to be a material consideration in respect of the assessment of the future planning application associated with the Project.

The Project site is located within SDZ 1 – Energy Corridor, where a focus on the development of the energy sector and the linking of Hull Green Port with other economic and redevelopment areas are to be promoted.

4.4 Local Policy

The statutory development plan for East Riding of Yorkshire Local Authority consists of the following documents:

- East Riding Local Plan Strategy Document (adopted April 2016)

- Allocations Document (adopted July 2016)

Emerging planning policy:

- Draft Local Plan update
- Draft Flood Risk Sequential and Exception Test SPD

4.4.1 East Riding Local Plan Strategy Document

The East Riding Local Plan Strategy Document is a key component of the East Riding Local Plan which aims to respond to the challenges and capitalise on the opportunities within the East Riding. It is a long-term plan providing the over-arching strategic planning framework for the East Riding to 2029. The document sets out its vision for the East Riding which includes a range of objectives that will work towards sustainable development. The policies in the document aim to support growth whilst protecting those characteristics that make the East Riding special.

Policies relevant to the AHP Project include:

- Policy S1: Presumption in favour of sustainable development
- Policy S2: Addressing climate change
- Policy S3: Focusing development
- Policy S6: Delivering employment land
- Policy H4: Making the most efficient use of land
- Policy EC1: Supporting the growth and diversification of the East Riding economy
- Policy EC4: Enhancing sustainable transport 105
- Policy EC5: Supporting the energy sector
- Policy ENV1: Integrating high quality design
- Policy ENV2: Promoting a high-quality landscape
- Policy ENV3: Valuing our heritage
- Policy ENV4: Conserving and enhancing biodiversity and geodiversity
- Policy ENV5: Strengthening green infrastructure
- Policy ENV6: Managing environmental hazards
- Policy C1: Providing infrastructure and facilities
- Policy A5: Holderness and Coastal Sub Area

4.4.2 Key Spatial Issues

The Plan highlights Key Spatial Issues that it intends to address, facilitate, and have an impact on. These are largely concerned with the economy, the environment, and people and places. It is significant that the Plan acknowledges how crucial Enterprise Zones are to East Riding's economic growth.

The AHP project is located on an existing SSE operated brownfield gas storage site, with this located on the outskirts of Aldbrough. In total, there are 21 objectives that have been identified in the strategy which aim to achieve the vision set out in the East Riding Local Plan. The objectives provide and state the key principles on management of the development over the planned period, with these to be realised by applying the policies of the Strategy Document and subsequent Local Plan documents.

The majority of the polices hold high relevance to the proposed project, whilst A Prosperous Economy and A High-Quality Environment further support and promote the importance of industry and economic development, balanced with the needs of the environment.

4.4.3 Climate Change

As stated in Policy S2: Addressing climate change the development plan supports the aim of reducing greenhouse gas emissions and adapting to the expected impacts of climate change. The Policy provides details on how East Riding aims to address environmental impacts due to climate change with the development plan following the advice and direction set by The National Strategy for Climate and Energy. The policy provides an overview on how it aims to deliver the goals in Policy S2 with this shown in table 1[3]. In total there are 14 key objectives with point 6 "*Promote the creation of economic clusters for the renewable and low carbon energy sector*" and point 8 "*Promote renewable and decentralised energy generation in appropriate ENV1 and EC5 locations*" being the points the development would benefit in addressing the aims of Policy S2.

Policy EC5: Supporting the energy sector, states the importance of supporting renewable energy development within the area, with section 7.60 stating that the development plan will support projects that provide *"growth in the low carbon and renewable energy sector of the economy and reductions in emissions that cause climate change".* The policy states its support for carbon capture and storage whilst stating that *"it will be supported where any significant adverse impacts are addressed satisfactorily, and the residual harm is outweighed by the wider benefits of the proposal*." EC5 acknowledges the importance of renewable energy in terms of its importance in addressing climate change with this policy being interlinked to goals set out in Policy S2.

4.4.4 The Economy

Policy S3: Focusing Development acknowledges the need for new developments stating that new developments will be supported where it is focused within Rural Service Centres such as Aldbrough. Section F of Policy S3 further states that in order to maintain the overall vitality of rural areas, Rural Service Centres and Primary Villages will support development to meet the needs of the local community and sustainable economic growth. This will help towns fill some of the basic needs outside of the Major Haltemprice Settlements and Principal Towns.

Policy S6: Delivering Employment Land states the aim to support jobs and businesses to ensure that the East Riding can maximise opportunities for economic development where market demand is high, as well as stimulate activity in areas in need of regeneration. Policy S6 focuses particularly on the land requirement for uses on 'B class land, with this policy interlinking with S3 and offering a means to increase the local economy, with storage being notified as a potential means of increasing employment with this set out in the strategic document.

Policy S6 further states in paragraph 5.23 that "*the Humber Local Enterprise Partnership (LEP) area has been identified by Government as a national ''Centre for Offshore Renewable Engineering' (CORE), and 536 hectares (ha) of land has been designated as part of the 60 East Riding Local Plan Strategy Document*."

With the document providing details on managing and distribution of new renewable energy developments classed as "Super Clusters" this includes the site in question.

In regard to the development of class B land, the ERYC states that "*all proposals must be considered in the context of the statutory protection which is afforded to the Humber Estuary Special Area of Conservation (SAC). Any development will also be required to preserve or enhance those elements which contribute to the significance of the designated heritage assets in the area*."

Policy EC1: Supporting the growth and diversification of the East Riding economy, promotes the strengthening and growth of the East Riding economy and employment through encouraging

[3] Table 1 How Policy S2 is delivered in the Strategy Document, Page 39, East Riding of Yorkshire LDP

developments that positively contribute to employment sectors and clusters, including renewable energy, chemicals, and ports as stated in section A, with this providing further support to Policy S6 on the utilisation of Class B Land.

Policy A5: Holderness and Coastal sub area provides details, plans and strategies to development and grow the local region of East Riding. The document states in point 8 of section B Economy *"that there will be support for necessary infrastructural developments associated with the gas terminals at Easington and the infrastructure required to deliver offshore renewable energy developments*." The document further states the important part the local area plays in gas storage and energy development at caverns like Atwick and Aldbrough.

4.4.5 Environment

Section 8: A High Quality Environment provides details on the policies and strategies it has put in place to safeguard the wild areas whilst promoting green growth. The document has created a framework for managing environmental risks with the aim of protecting communities and wildlife from hazards that are intolerable, such as flooding, coastal change, contaminated land, dangerous equipment, groundwater pollution, or other types of pollution.

Policy ENV1: Integrating high quality design states the importance of having a good design that safeguards heritage, biodiversity, key landscapes and green infrastructural assets whilst working towards the policies aim of reducing carbon emissions in the land, energy and water sectors. The policy provides details on factors that must be considered for all new projects that wish to be built within the area. The policy further states in section D that "*Where possible, the design of development that maximises the use of decentralised and renewable or very low carbon technologies will be supported*", with this highlighting the weight of importance that East Riding have put on renewable energy development.

Policy A5: Holderness and Coastal Sub Area section C further reiterates the importance to protect and safeguard the local environment whilst providing highly needed infrastructures within the area.

4.4.6 Biodiversity and Geodiversity

There are a significant number of biodiversity assets, and biodiversity and geological designations within East Riding, many of which have been under threat or in decline. Future development and projected climate change present further challenges to protecting and enhancing these resources.

New developments are expected to optimise opportunities to safeguard biodiversity and geodiversity, and where possible, deliver enhancements that result in a net gain in biodiversity.

Policy ENV4: Conserving and enhancing biodiversity and geodiversity, provides the assessment criteria against which developments are assessed in relation to their impact on International, National and Local designated sites. It also states that development should further the aims of the East Riding of Yorkshire Biodiversity Action Plan (ERYBAP), designated Nature Improvement Areas (NIAs) and other landscape scale biodiversity initiatives.

The Humber Estuary is a Ramsar site, a Special Protection Area (SPA), an SAC, and a Site of Special Scientific Interest (SSSI). Easington Lagoons, which lies near the southernmost point of the Holderness Coast, and Hornsea Mere, which is to the west of the town, both have additional SSSI and SPA classifications. In addition, Hornsea Mere, Cowden Ranges, and Lambwath Meadows have designated Biodiversity Priority Areas within which landscape-scale projects are planned. Spurn Point is a distinctive feature and one of the largest coastal sand dunes in the area; as a result of its uniqueness and strategic significance, it has been declared as a Heritage Coast.

As the Humber Estuary is a designated European Site, any development likely to have a significant adverse effect on it, either alone or in combination with other plans or projects, would be subject to an assessment under the Conservation of Habitats and Species Regulations 2017.

The Strategy goes on to state that development should contribute positively and further the aims of designated sites, and that any development that would have an adverse impact on a designated site, an important habitat, or species, and/or a habitat network, should be avoided as far as possible. If this cannot be achieved, the adverse impacts must be adequately mitigated, or, as a last resort, compensated for.

4.4.7 Managing Environmental Hazards

Due to its low-lying topography and geographical location, East Riding is particularly vulnerable to environmental concerns related to flood risk, coastal change, and groundwater pollution. As a result, measures must be considered to address these potential issues when creating new and necessary infrastructure.

Policy ENV6: Managing environmental hazards states that "*The risk of flooding to development will be managed by applying a Sequential Test to guarantee that growth is steered towards areas of lowest risk, as far as practicable (SFRA*)". Under guidelines set all new potential developments must not increase the risk of flooding.

Policy ENV6 further states that environmental hazards such as flood risk, coastal change, groundwater pollution and other forms of pollution, will be managed in order to prevent the development from having harmful impacts on its users, the surrounding community, and the environment. The policy provides full details on avoidances for environmental risks, and as such new developments must adhere to the stipulations set out in order to mitigate potential hazards. Further on, Policy ENV6 states that environmental hazards such as flood risk, coastal change, groundwater pollution and other forms of pollution, will be managed in order to prevent the development from having harmful impacts on its users, the surrounding community, and the environment.

Under the subsection groundwater pollution, it is stated that "*Development of previously developed land, and/or land affected by contamination, can pose a risk to both groundwater and surface water. Where relevant, it will be necessary to identify and ensure that these risks are addressed as part of the proposed development. In some cases, remediation of land may be required to prevent future contamination of groundwater and surface water*", with the location of the site, it is important that the developments can mitigate any potential issues regarding ground water pollution.

Due to the Proposed Development being located on an operational gas storage facility cavern, it may need to consider the impact of contaminated land prior to being recommissioned as stated in paragraph 8.85.

As stated in paragraph 8.88 Hazardous Substance Consent may be required for industrial operations, including the storage of particular materials.

4.4.8 East Riding Local Plan 2012-2029 Allocations Document

An integral part of the East Riding Local Plan is the Allocations Document. It identifies specific sites where development will come forward, providing guidance on development and planning policy. The development of these sites will help respond to the challenges and opportunities identified in the East Riding, particularly in terms of delivering much needed housing and providing space for businesses to grow and invest.

The AHP project site is not identified as a specific allocation within the document; however, the site does fall into the category for growth stated in policy ALD-A and ALD-C. Due to the village of Aldbrough being classed as historic, it is important that all new development in the form of either housing or business development do not cause impact on graded buildings in the area as stated under the Aldbrough Conservation Area Appraisal.

The site allocation and supporting information provides support in the case for renewable development in the form of Green Hydrogen, the site will fall within the area shown for development and due to its location will not cause visual impacts to the local Aldbrough village.

4.5 Emerging Policy

4.5.1 Local Plan Update

The current East Riding Local Plan was adopted in 2016 as such the council is required to assess whether a review of the Local Plan is needed within five years of adoption. Their assessment has found that an update is required to respond to:

- changes in the new NPPF
- issues identified in the inspector's report on the Local Plan examination; and
- the monitoring of current Local Plan policies and updates to the Evidence Base.

Consultation was undertaken in the summer of 2021, presenting the first full draft of the East Riding Local Plan. Responses to this consultation will be considered by the Local Authority and a 'pre-submission' Local Plan document will be prepared. This will be consulted on and then submitted to the Secretary of State for examination.

The document is not yet adopted, though it is an indication of the 'direction of travel' of the emerging planning policy and updates to the Local Plan.

4.5.2 Economy

The draft Local Plan Update seeks to further on the importance in creating a strong and diverse economy, whilst addressing key economic issues that include: the growth of key employment sectors; safeguarding Key Employment Sites; supporting rural diversification; tourism and the visitor economy; retail and town centre uses; accessibility and parking standards; growth of the energy sector; and protecting mineral resources. The Plan keeps the same ideology with regards to sustainable development and the importance of retaining employment at key sites and provides reference to the Aldbrough's unique caverns for gas storage as a means for employment and to work towards decarbonisation of the UK's energy sector.

4.5.3 Energy and Low Carbon Sector

Policy EC5: Supporting the renewable and low carbon energy sector has provided an update to increase the amount of energy produced from renewable and low carbon technologies as the policy brings awareness to the importance in addressing the UK's carbon emissions. Policy EC5 has implemented acknowledgment and support for alternative energy sources like hydrogen and carbon capture as additional methods to address the UKs need to decarbonise the energy sector. Policy EC5 has updated its acknowledgement for gas storage via its unique caverns "*The underground salt deposits between Withernsea and Bridlington make the sub area one of the few locations in the UK that are suitable for gas storage facilities*".

4.5.4 Climate Change and Environment

Climate change is a key issue addressed in the Local Plan, from encouraging well-designed development (Policy ENV1), to promoting sustainable transport (Policy EC4), and conserving and enhancing biodiversity and geodiversity (Policy ENV4) to supporting the renewable and low carbon energy sector (EC5). A number of policies seek to reduce carbon emissions and support mitigation against the effects of climate change.

Policy ENV 6 addresses, alongside other environmental hazards, coastal change. The eastern area of the Proposed Development falls within a designated Coastal Change Management Area and policy ENV 6 requires developments within the Coastal Change Management Area to ensure that the development is safe from the risks associated with coastal change for its intended lifespan among other matters.

The Draft Local Plan Update seeks to retain and enhance the East Riding's high-quality environment. It provides information on the environmental challenges with a series of policies to guide development that aim to promote good quality design and protect and enhance the area's valuable landscape, heritage, biodiversity, and blue/green infrastructure assets. It also establishes an approach to managing environmental hazards.

4.5.5 Draft Local Plan Allocations Document May 2021

As with the existing adopted Allocations document, the AHP Project site is not identified as a specific allocation within the document, other than the site falling into the categories for growth stated in policy ALD-A and ALD-C. There is an inclusion of the benefits of gas storage stated in paragraph 15.1 “The large gas terminals to the north of Easington are prominent features in the landscape and provide local employment opportunities”.

4.5.6 Draft Flood Risk Sequential and Exception Test Supplementary Planning Document (SPD) (January 2021)

The SPD has been prepared to aid developers, applicants, and Local Planning Authority officers on how to apply local and national planning policy using, amongst other evidence, the Council’s Strategic Flood Risk Assessment (SFRA).

It focuses on flood risk Sequential and Exception Test considerations in relation to planning applications and provides information in relation to the flood risk considerations of the unique locations within East Riding, particularly in relation to the Humber Estuary.

5. ALTERNATIVES

5.1 Hydrogen Facility Site Selection

Several factors in combination were relevant to site selection and these constrained the number of realistic options. The main factors were:

- existing means of safely storing the hydrogen;
- water availability for hydrogen production;
- grid connection for hydrogen production and generated power export; and
- since the first factor effectively dictated storage underground in caverns in salt structures, the means of brine disposal.

During the feasibility phase of the Proposed Development, two existing natural cavern storage sites were considered for the storage of the hydrogen produced: Atwick 10 Site and the Aldbrough 1 Storage Site.

The Aldbrough Storage Site is the preferred option for the hydrogen storage into the Proposed Development. This is due to the favourable geology, and this site has no requirement for major well remediation works to resolve existing defects. In comparison, the Atwick 10 cavern well would require significant remedial works for the conversion to hydrogen storage thus extending the construction programme.

For connectivity to the national electrical grid infrastructure, the Atwick 10 site presented a number of risks. In the absence of the availability of the existing connection a potential new Distribution Network Operator (DNO) connection would be required which could have significant impacts on the programme and costs, At Aldbrough 1 site, the connectivity to the national electrical grid infrastructure is less complex. The export of the power is achievable via the existing assets and would not require a new connection to a network.

5.2 Alternative Brine Discharge Options

During the construction phase, approximately 60,000m^3 of brine will be removed from the Aldbrough 1 cavern and will require disposal. There are three approaches currently being considered:

1. Discharge of the water to sea. An existing decommissioned pipe and diffuser running east from the Aldbrough Gas Storage site to the coast could be recommissioned. Beyond the mean low water mark, the marine aspect of this proposal does not fall within the jurisdiction of this Scoping Report;
2. Rewatering of ALD4z cavern and its subsequent decommissioning; or
3. Tankering of the water off site with disposal at the nearby licenced SSE Atwick site or an alternative disposal site.

At present it is not known whether discharge to sea or the rewatering of the ALD4z cavern are technically feasible. This is the subject of ongoing review. If they are not, the water may be tankered offsite to a suitable discharge location. Assuming vehicle movements over six days a week and a capacity per tanker of 30 cubic metres, movement of the water off site would take approximately 40 two-way tanker movements per day over a four-month period.

6. EIA METHODOLOGY

6.1 Introduction

This section describes the broad principles of the methodology that will be adopted for the EIA. It describes the approach that will be used to identify and assess environmental effects. It also sets out how the temporal, spatial and technical scopes of the EIA will be developed. Further details for individual topic methodologies are provided in Sections 7 to 19.

6.2 EIA Regulations and Guidance

EIA is a procedure required under the terms of the European Union Directives 85/337/EEC and 97/11/EC on the assessment of the effects of certain public and private projects on the environment.

The primary objective of an EIA is inscribed under Article 2 of the directive which states that: *"Member States will adopt all measures necessary to ensure that, before consent is given, projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location are made subject to a requirement for development consent and an assessment with regard to their effects."*

Article 8 of the Directive also states that: *"The results of consultations and information gathered pursuant to (the EIA procedure) must be taken into consideration in the development consent procedure".*

The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the 2017 EIA Regulations) implement the EIA Directive in England for certain types of projects which are deemed to be 'EIA development'.

In practical terms, the purpose of the EIA documentation is to inform the local planning authority (who will examine the application and determine whether consent should be granted) and to provide a source of information for stakeholders (including the statutory consultees), regarding the likely significant environmental effects associated with a development during its construction, operation and (where relevant) decommissioning.

As such, the likely significant effects of the Proposed Development will be identified for each relevant EIA topic. This will be done by comparing baseline environmental conditions (i.e. the situation without the AHP project) with the conditions that would prevail were the Proposed Development is to be constructed and operated. The significance of these changes will be assessed against such matters as the possible breach of a limit or capacity of the natural environment to absorb the resultant effect.

Effects will be assessed in relation to environmental receptors, that is: people (e.g. residents of buildings, users of facilities, employees of businesses), built resources (e.g. listed buildings) and natural resources (e.g. protected species, sites of ecological importance).

In addition to the relevant directives and regulations the EIA will be undertaken with reference to the following documents (plus topic-specific guidance), amongst others:

- Guidelines for Environmental Impact Assessment, IEMA, 2004;
- Guide to Shaping Quality Development, IEMA 2015; and
- Delivering Proportionate EIA, A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice, IEMA 2017.

6.3 Baseline for the EIA

Schedule 4 of the 2017 EIA Regulations (paragraphs 3 and 4) requires the EIA baseline to provide:

- A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.
- A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.

Sections 7 to 19 describe the data sources to be used and the baseline studies that will be undertaken for the EIA.

6.4 Identification and Assessment of Effects

Figure 6-1 sets out the general approach to the assessment of likely significant effects that may arise from the Project.

Whilst **Figure 6-1** provides a general framework for identifying impacts and assessing the significance of their effects, in practice the approaches and criteria applied across different environmental and socio-economic topics vary. Sections 7 to 19 outline the proposed approaches to the technical topics that will be addressed in the EIA.

To the extent necessary all the technical topics will address the construction, operational and decommissioning phases of the Proposed Development. However, as decommissioning will be more than 25 years in the future it will not be addressed to the same level of detail as the other phases. In general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

In accordance with Schedule 4 paragraph 5 of the 2017 EIA Regulations, the identification and assessment of effects for each topic will include an assessment of direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term, and long-term, permanent and temporary, positive and negative effects of the development, to the extent they are relevant.

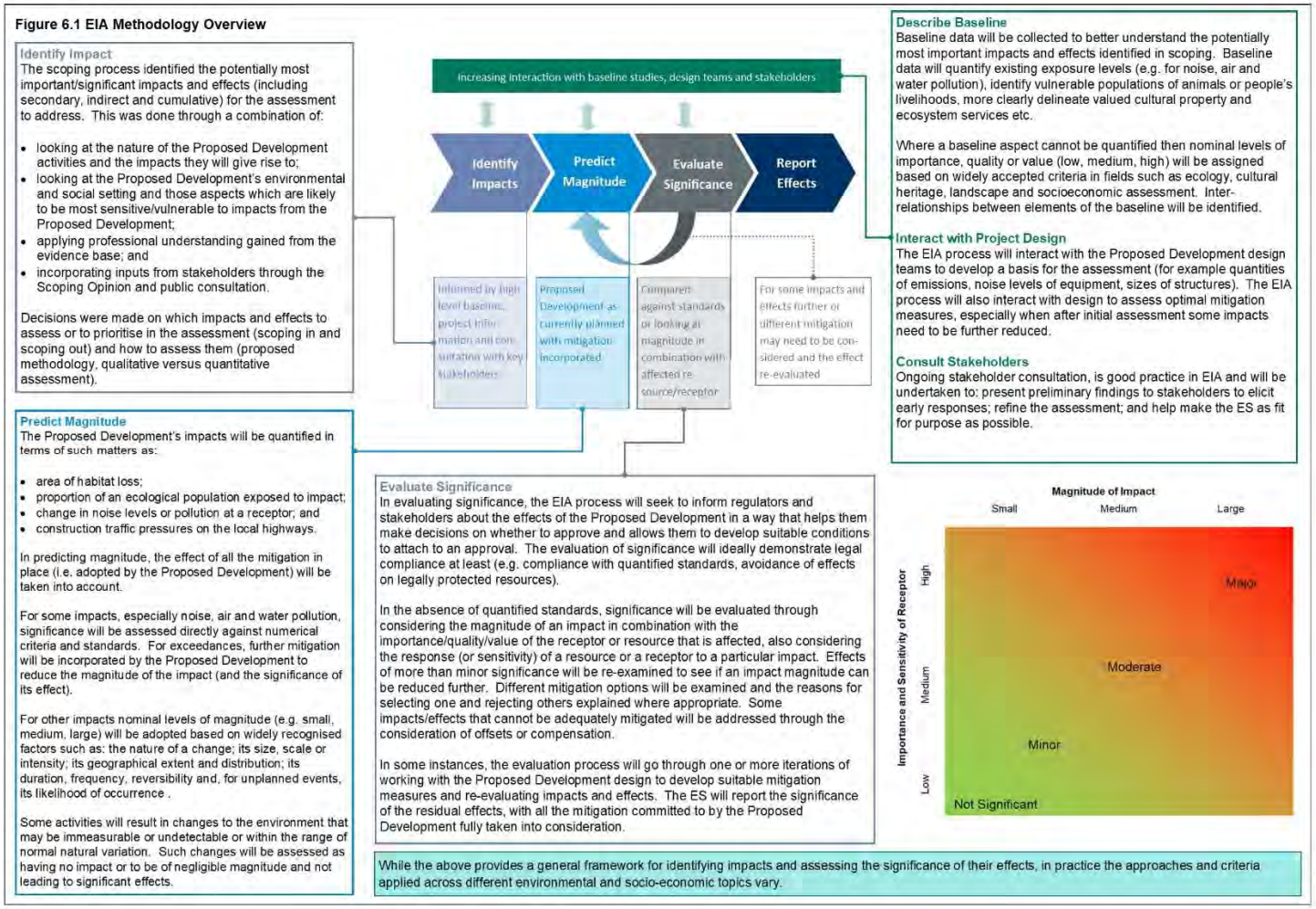
Where inter-relationships exist between different aspects of the environmental and socio-economic setting for the Project, and where an impact or effect on one aspect is identified, the assessment will consider the effect (or effects) this may have on the related aspect (or aspects) of the receiving environment. Inter-relationships may include:

- traffic and noise and human health;
- the value of a feature of cultural heritage being related to its setting; and
- emissions to atmosphere and effects on habitats from the deposition of pollutants.

Projects, plans and proposals with which the Proposed Development may have cumulative effects will be identified in consultation with the local planning authority and assessed accordingly.

There is no widely accepted definition of ‘indirect’ effects; the term is often used interchangeably with ‘secondary’ effects. However, the 2017 EIA Regulations do distinguish between the two terms. For the purposes of this EIA, ‘secondary’ (and higher order) effects are taken to be part of a chain of impacts or effects that can be readily traced back to an action of the AHP project.

Figure 6-1 EIA Assessment Approach



Indirect effects may be the consequence of an action of the Proposed Development and occur much later in time or, are much farther removed in distance, albeit still reasonably foreseeable. Indirect effects may also include the consequences of economic or population growth induced by a project and other effects related to induced changes in the pattern of land use, population growth rate, and related effects on air, water and soil and ecosystems in general. In the context of the AHP Project 'indirect effects' falling within this definition are proposed to be scoped out.

6.5 Mitigation

Schedule 4 (Part 1 paragraph 21) of the 2017 EIA Regulations requires that where significant effects are identified the ES should include the following: "*A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.*"

The achievement of high environmental standards is integral to the AHP Project. Measures to avoid, minimise and reduce impacts will be integrated into the design of the Proposed Development as well as into construction methodologies.

For each significant negative effect of the Proposed Development that is identified during the EIA, the specialists undertaking the assessments will identify mitigation measures consistent with statutory requirements and good practice in their respective fields. These measures will be committed to through a number of means, for example: integration into design; by imposition of conditions; or through a Code of Construction Practice or equivalent.

Residual effects, once mitigation measures have been incorporated into the Proposed Development design (and into its construction and operational practices), will be classified as not significant or still significant (albeit reduced), as appropriate. Where effects are still significant, the mitigation options considered and the reasons for selecting particular measures will be reported in the ES.

6.6 Environmental Management

In addition to the specific mitigation measures identified for each of the environmental topics, the Proposed Development will conform to general environmental management practices. Under the Construction (Design and Management) Regulations 2015, the Project's Construction Environmental Management Plan (CEMP) (or similar) will include general environmental and health and safety considerations.

It is no longer a formal requirement for developers to produce a Site Waste Management Plan (SWMP). Nevertheless, it is recognised that construction, operation, and demolition stages all have the potential to create waste. The Proposed Development will adopt good construction and management practices to ensure waste is minimised as far as possible and that the storage, transport and eventual disposal of waste have no significant environmental effects. Management and collection of the waste streams will be carried out under the requirements of the UK waste regulatory regime.

6.7 Engagement

This section provides a summary of the engagement and consultation activities undertaken by SSET to inform the EIA. A detailed stakeholder mapping exercise was undertaken to identify key statutory and non-statutory stakeholders of the AHP Project.

The Project Socialisation Stage of engagement is being facilitated as a pre-consultation stage, to introduce the project to key stakeholders, consultees and the wider community, and there be a single stage of pre-application consultation undertaken later in 2023. Included in the wider engagement programme is the Community Liaison Group (CLG), which has representatives from SSE, ERYC,

Aldbrough and Garton Parish councils, and other relevant local interest groups. This group usually meets monthly in Aldbrough, to discuss project information and create an open forum to discuss issues or concerns regarding the project. These meetings are also open to members of the public to join as observers.

This stage of engagement has allowed for the initial presentation of information regarding the AHP Project proposal, as well as to commence the building of relationships and understand key concerns, opportunities, or recommendations before going out for pre-application consultation.

The following meetings have been undertaken as part of this stage of engagement:

Table 6-1 Stakeholder Meetings Undertaken

MEETING DATE	STAKEHOLDER/ORGANISATION	TOPIC
8 November 2022	East Riding Yorkshire Council	AHP introduction
9 November 2022	CLG	AHP introduction
15 December 2022	CLG	AHP introduction and scoping
19 January 2023	CLG	AHP project update
2 March 2023	CLG	AHP project update

In addition to meeting with key statutory consultees and stakeholders, the public will be informed of the Proposed Development. The website will be updated with basic project information and contact details. A newsletter will also be distributed in hard copy to a pre-determined consultation area. The newsletter will provide the local community with information regarding the project proposal and location. The newsletter will also detail information on project timelines and provides the project website and contact details.

The ES will clearly set out how consultation on the AHP Project has been addressed in its design, developing mitigation, and assessing effects.

6.8 Scope of the Assessment

6.8.1 General Considerations

The scope of the assessment falls under three broad categories:

- technical scope;
- spatial scope; and
- temporal scope.

6.8.2 The Technical Scope

Sections 7 to 19 set out the approach to be adopted for each technical topic (the ‘technical scope’) that makes up the EIA. In some instances, reference is made at the topic level to the spatial and temporal scopes, and these will be refined further in the course of the EIA and reported in the ES.

6.8.3 The Spatial Scope

In general terms, the spatial, or geographical scope of the assessment will take into account the following factors:

- the physical extent of the proposed works, as defined by the design;
- the nature of the baseline environment and the manner in which particular impacts are likely to be propagated from their source; and
- the pattern of governmental administrative boundaries, which provide the planning and policy context for the project.

For example, any potential effects on buried archaeology would tend to be confined to those areas physically disturbed by the works, whilst the effects of noise or visual intrusion could potentially be experienced at some distance from the works.

Appropriate study areas will be considered for each environmental topic by the specialists undertaking that assessment, and in agreement with the relevant consultees.

6.8.4 The Temporal Scope

Overview

The temporal scope of the assessment generally refers to the time periods over which impacts may be experienced. This will be established for each discipline, where appropriate through discussion with the relevant statutory consultees.

Terms used to qualify the duration of an impact or effects will tend to be specific to the topic being considered.

Construction Phase

Construction phase impacts may potentially arise during the whole of the construction works, which is expected to last approximately 36 months.

The construction phase will not be one continuous activity of the same intensity. There will be periods of noisy activity and periods of more intensive traffic movements. The overall construction phase will be divided up into component activities allowing the durations of particular impacts and effects to be assessed and clearly reported.

The assessment will also take into account the time of day during which works are likely to be undertaken, notably whether they will be undertaken during daytime or night-time periods.

Operational Phase

The operational phase of the Proposed Development will begin once the OCGT begins commercial operations. This is anticipated to be in Q4 2026. The surface equipment has a design life of 25 years. The subsurface infrastructure has a design life of 40 years with Aldbrough 1 cavern completed in 2012.

Decommissioning Phase

It is anticipated that the Proposed Development will be operational for 25 years. If at the end of the operational phase, the decision is taken to decommission the surface and sub-surface infrastructure the decommissioning will be carried out in two phases as follows:

- Hydrogen production plant and OCGT removed and site restored; and
- Cavern and well decommissioning.

It takes approximately six years to decommission a well and cavern due to a five year suspension monitoring period prior to abandonment.

6.9 Applying the 'Rochdale Envelope' Approach

The EIA will be undertaken in parallel to a pre-FEED (Front-end Engineering and Design) process. Following pre-FEED (and the planning submission), further work will be undertaken in terms of the FEED process itself, followed by detailed design and the development of construction working methods by an Engineering Procurement and Construction (EPC) contractor. The FEED and detailed design processes will in part be iterative with seeking an Environmental Permit to operate the AHP Project. Elements of the design may therefore also be influenced by discussions with the Environment Agency and Health and Safety Executive. A degree of flexibility is therefore needed by the Proposed Development during pre-FEED (and FEED) to allow future changes to be contained with the parameters determined by a planning consent.

These requirements for flexibility introduce some complexity into the EIA process common to many large-scale developments. The 2017 EIA Regulations require an ES to provide a description of the location, design, and size of the scheme to allow the likely significant environmental effects to be assessed and to allow the local planning authority, statutory consultees, and the public to develop an informed response.

A balance has to be sought, therefore, between defining the Proposed Development in enough detail to predict its impacts, whilst leaving sufficient flexibility to allow the project to be successfully delivered under conditions which may be subject to change. The Proposed Development design (or elements thereof) will be expressed as an 'envelope' for the purpose of assessing its impacts or possible range of impacts, including 'worst-case' impacts. In order to ensure that likely significant effects of the Proposed Development on the environment are appropriately described and assessed, parameters will be set which:

- are broad enough to encompass the potential variations in design and other aspects of the Proposed Development as it moves forward through later stages of design, after a planning consent may have been granted; but
- provide sufficient detail to make an assessment of the effects and allow informed decisions on the application.

The EIA will therefore take account of all the reasonable variations in the form of the Proposed Development that would be permissible under the parameters and describe and assess the likely significant effects on the environment as appropriate.

Such an approach is good practice, as reflected in case law on the 'Rochdale Envelope' principle. Suitably applied in EIA it can help to avoid the need for protracted re-submission procedures at a later stage, whilst giving a comprehensive assessment of the likely environmental effects.

6.10 Consideration of the Main Alternatives

Schedule 4 (paragraph 2) of the 2017 EIA Regulations requires developers to outline the main alternatives they have studied and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects. The EIA will therefore consider the main alternatives and set out the main reasons for the applicant's choice, taking into account the environmental effects and the applicant's overall objectives for the Proposed Development.

The EIA will address alternatives including location and technology. It will also include consideration of the Proposed Development design, methods of construction or operation that will avoid, minimise, reduce, or remedy likely significant environmental effects. Where appropriate, the main reasons for selecting a particular alternative will be explained, taking into consideration technical and economic feasibility, as well as the environmental effects.

6.11 Cumulative Effects

The Proposed Development will be considered in the context of both baseline conditions and schemes that are in the development phase or may be developed in the future, and the resultant

environmental effects of the Proposed Development and such schemes coexisting. These effects are termed cumulative effects.

The assessment will consider the accumulation of effects on people and the environment, even if the Project, when assessed on an individual basis, has effects that are not significant.

The 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' [4] provides the following guidance on cumulative effects:

- *"In practical terms, the extent of the assessment in terms of how far into the past and into the future will be dependent upon the availability and quality of information…"*
- *"…it is only reasonable to consider current events and those that will take place in the foreseeable future. Furthermore, the assessment can only be based on the data that is readily available."*

It should be noted that for a scheme to be considered in the cumulative assessment, the principles set out in the guidance document discussed above will be followed. This means that only those schemes that could reasonably be presumed to go ahead, and for which sufficient information was available, will be taken into account.

For the purposes of this EIA, this will relate to those schemes that currently have planning permissions or for which planning applications have been submitted to the relevant authority and are of a scale and nature to make a likely material contribution to cumulative effects along with the Proposed Development. On this basis it is proposed that only those schemes that are, or were, classified as 'EIA development' will be considered. Other schemes may be added at the discretion of ERYC.

6.12 Dealing with Uncertainty

Even with a final project description and an unchanging environment, predictions of impacts and their effects on resources and receptors can by definition be uncertain. Predictions can be made using varying means ranging from qualitative assessment and expert judgement (including reference to the evidence base) through to quantitative techniques (e.g. modelling). The accuracy of predictions depends on the methods used and the quality of the input data for the Proposed Development and the environment. Where an assumption has been made, the nature of any uncertainty will be presented in the ES.

Where uncertainty affects the assessment of effects, a conservative (i.e. reasonable worst case) approach to assessing the likely residual effects will be adopted with mitigation measures developed accordingly.

To verify predictions and to address areas of uncertainty, monitoring will be proposed as a key aspect of environmental management for the construction and operation of the Proposed Development.

[4] European Commission (1999) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*. Available online: http://ec.europa.eu/environment/eia/eia-studies-and-reports/guidel.pdf

7. GEOLOGY AND GROUND CONDITIONS

7.1 Introduction

This section of the Scoping Report identifies the geology and ground conditions of relevance to the Proposed Development and considers the potential effects from construction, operation, maintenance, and decommissioning activities. Due to the nature of the Proposed Development, the greatest potential for likely significant effects on soils and geology is during the construction phase. Impacts on geology and ground conditions includes consideration of secondary effects on human health (construction workers) as well as the environment.

Consideration is given to land that potentially contains contamination and land that has special geological significance, from a scientific, historical, mineral exploitation or mineral resources point of view, including geological SSSI and areas of designated mineral resources.

7.2 Topic-specific Regulatory Requirements and Guidance

The assessment will be undertaken in line with the following policy and guidance.

- European Union Water Framework Directive (2000/60/EC)[5]
- The Environmental Protection Act 1990[6]
- European Union Groundwater Directive (2006/118/EC) 2006[7]
- Water Resources Act 1991 as amended by the Water Act 2003[8]
- EA/DEFRA Land Contamination Risk Management (LCRM) 2020[9]

7.3 Baseline Environment

7.3.1 Data Sources used in Scoping

The date sources used for this assessment as part of the Scoping Report are:

- British Geological Survey (BGS) Solid and Drift Geology, 1:50,000 England and Wales Sheet 73 – Hornsea;
- BGS GeoIndex Onshore interactive viewer (accessed November 2022);
- Aldbrough Hydrogen Pathfinder Feasibility Study Report, Atkins (October 2022) ref. 5215677-MD-REP-002;
- Aldbrough Hydrogen Pathfinder Wells Basis for Design, Atkins (October 2022) ref. 5215677-WL-BOD-001;
- Aldbrough hydrogen Storage (AHS) Feasibility Study Report, Atkins (April 2022) ref. PM813-AT-A-IC-00001;
- DEFRA Magic map (accessed November 2022);
- Coal Authority Interactive Viewer (accessed November 2022);

[5] European Union (2000) *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy*. Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

[6] UK Government (1990) *The Environmental Protection Act 1990*. Available online at: https://www.legislation.gov.uk/ukpga/1990/43/contents

[7] European Environment Agency. *Groundwater Directive (GWD) 2006/118/EC*. Available online at: https://www.eea.europa.eu/policy-documents/groundwater-directive-gwd-2006-118-ec

[8] UK Government. Water Act 2003. Available online at:

[9] Environment Agency (2020) *Land Contamination Risk Management.* Available online: https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm

- East Riding of Yorkshire and Kingston upon Hull Joint Minerals Local Plan (adopted November 2019) and potentially contaminated land areas database;
- East Riding of Yorkshire Landfill dataset; and
- Natural England Open Data - Designated Sites (accessed November 2022).

Site-specific data will be reviewed from an environmental database (i.e., Landmark Envirocheck Report) and data held by the applicant (the landowner) once the search areas have been refined later in the EIA and in advance of issuing the ES. A targeted walkover of areas of interest will be undertaken as part of the assessment if the desk-based review indicates this is necessary.

7.3.2 Description

Land Use and Ground Conditions

The Proposed Development is located within a predominantly undeveloped rural area dominated by agricultural farmland and characterised by field boundaries and land drains adjacent to the coast. It is understood the area has remained this way to the present day, with very little industrial land use or potential contaminative activities. The exception being the Aldbrough Gas Storage facility (a licenced upper-tier Control of Major Accident Hazard (COMAH) site), which is located on the Site and first developed with a borehole in c.1993.

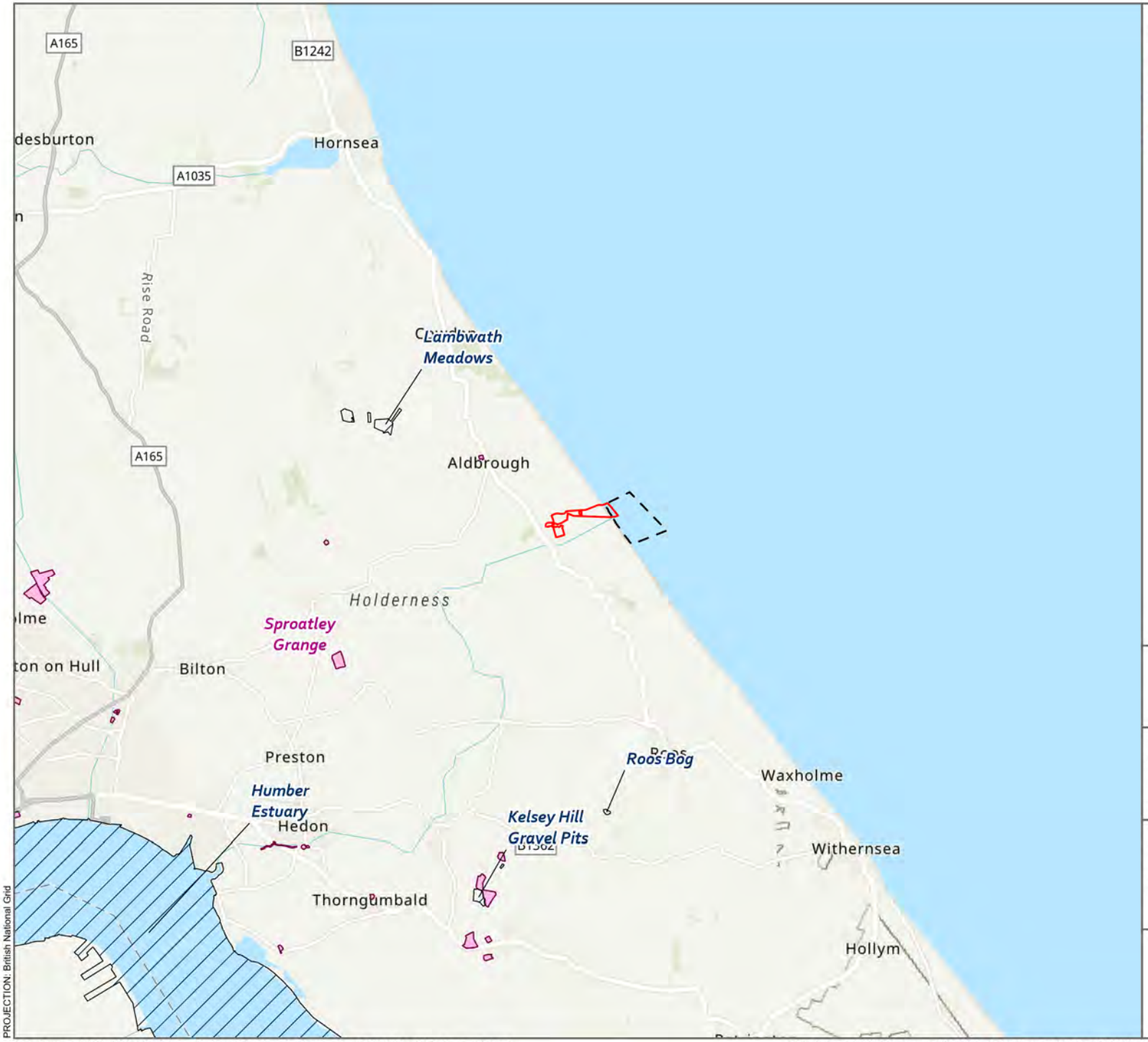
The Site includes nine cavities for the underground storage of natural gas with a capacity of around 300 mcm. SSE Hornsea holds an existing Pollution Prevention and Control Permit (ref. NE/EPRHP3336SL/001) for Aldbrough Phase 1 for the refining of natural gas in Process Train 1 and 2 from receipt of gas from storage caverns to despatch to gas metering system.

The Atkins AHS Basis of Design report[10] identifies three “unspecified tanks” at the far eastern edge of the Site on Aldbrough Sands beach near Ringbrough Farm. Ringbrough Farm was the historic location of an artillery battery during WWII. The battery and farm included barracks, guardroom, engine room, ammunition and the farm. Most of the buildings on site have either been lost to coastal erosion (approximately 2012) or demolished.

According to the ERYC landfill dataset, and as illustrated on **Figure 7.1**, there are no historic or current recorded landfill sites within 1 km of the Proposed Development.

Natural England classifies the majority of agricultural land within the study area as Grade 3 (‘good to moderate’) and Grade 2 (‘very good’) the permanent above-ground parts of the Proposed Development are located on previously developed land.

[10] AHS Basis for Design, Atkins (August 2022) ref. PM813-AT-Z-RA-00001



Site of Special Scientific Interest

Historic Landfill Sites

Site Boundary

Onshore

Offshore

0 1 2 3 4 5

Kilometres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: DN
PROJECT: 0653313	CHECKED: SE
DATE: 03/03/2023	APPROVED: RB

Figure 7.1
Potential Areas of Contamination and Sensitive Areas

ERM

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\0653313 - Project Accelerator\Maps\0653313 - Project Accelerator - A01.aprx\0653313 - Pathfinder - GY - Ground Conditions 10km - A01

Geomorphology

The regional and local geology is well defined within the Atkins Feasibility Study Reports, with data obtained during the Aldbrough Phase 1 development and operation.

The geology of the region is primarily Carboniferous to Cretaceous in age, deposited in the western part of the North Sea Basin. During the Permian period, the site was located on the western edge of the Zechstein Sea, which resulted in the deposition of evaporites including thick layers of soluble salt which are suitable for underground gas storage.

The Site is underlain by topsoil, followed by Quaternary glacial deposits (Glacial Till and Alluvium) from ground level to ~42 m below ground level (bgl). Below this lies a succession of Cretaceous (Rowe Chalk over Carstone) to ~607 m bgl, Jurassic (Lower Lias) to ~722 m bgl, Triassic (Penarth Beds and Mercia Mudstone over Sherwood Sandstone) to ~1,594 m bgl, salt bearing Permian Zechstein (unconfirmed thickness, to >1,949 m bgl) and Carboniferous (Coal Measures (unconfirmed thickness)) bedrock strata.

The Holderness coast is extensively made up of relatively 'soft' cliffs ranging from 3 m to up to 40 m in height. The ground is made up of silts and clays, with a thin sandy beach on top of a clay base layer in the inter-tidal zone. The cliffs are eroding rapidly at an average rate of 4 m per year and there is repeat landslide activity. However, the erosion tends not to occur on a steady basis, with none or very little for several years followed by relatively rapid losses of larger amounts. The Shoreline Management Plan[11] along this part of the coastline is to allow natural processes to continue along the frontage. There will be no management intervention or defences constructed on the currently undefended frontages from now until 2055.

Mineral Resources

There are no nationally designated geological SSSI sites or ERYC-designated Regionally Important Geological Sites (RIGS)[12] within 1 km of the Proposed Development. In addition, the East Riding of Yorkshire and Kingston upon Hull Joint Minerals Local Plan[13] (adopted November 2019) does not identify any mineral safeguarding areas in the vicinity. There are no artificial deposits identified within the local area.

The Site is underlain by deep coal deposits which are anticipated to be greater than 2,000m bgl. The Coal Authority online mapping[14] shows the Proposed Development is not located within an area of past or current coal mine workings. The offshore area immediately to the east of the Site is classified as a Coal Mining Reporting Area, extending from the mean low water mark to the east, approximately 4 km offshore. However, it is not identified as a Development High Risk Area in relation to coal mining.

The Proposed Development is located within Petroleum Exploration and Development License (PEDL) area no.183. The nearest operational fields are located near to the village of West Newton, for the recovery of shale gas.

Hydrogeology

The Environment Agency classifies the Glacial Till superficial deposits underlying the Site as a Secondary Undifferentiated Aquifer, which is a designation assigned in places "for which it is not

[11] Humber Estuary Coastal Authorities Group (2010) *Flamborough Head to Gibraltar Point Shoreline Management Plan.* Available online: https://www.eastriding.gov.uk/council/plans-and-policies/other-plans-and-policies-information/sustainable-environment-policies-and-strategies/

[12] East Riding of Yorkshire Council (2022) *Local Sites in the East Riding of Yorkshire (Part C)*. Available online: https://www.eastriding.gov.uk/environment/sustainable-environment/nature-conservation-and-wildlife/important-sites-for-wildlife/

[13] East Riding of Yorkshire Council and Full City Council (2019) *Joint Minerals Local Plan 2016 - 2033.* Available online: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/joint-minerals-plan/

[14] The Coal Authority (2022) *Interactive Map*. Available online: https://mapapps2.bgs.ac.uk/coalauthority/home.html

possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type". The Alluvium is classified as a Secondary A Aquifer, which is defined as "*permeable layers that can support local water supplies and may form an important source of base flow to rivers*".

Anticipated depth to groundwater within the superficial deposits is unknown, but it anticipated to be willow due to the low elevation of the Site and proximately to surface water courses and the North Sea.

The Rowe Chalk Formation bedrock is classified as a Principal Aquifer, having "*high intergranular and/or fracture permeability meaning it can usually provide a high level of water storage and may support water supply and/or river base flow on a strategic scale*".

The Environment Agency has classified the underlying regional groundwater unit as having 'Poor' quantitative and chemical quality under the Water Framework Directive (WFD) classification scheme in 2019. It is further believed that the aquifer will be subject to saline intrusion and is unlikely to be used as a potable water supply.

There are no groundwater Source Protection Zones (SPZ) designated to protect public groundwater supply abstractions within 1km of the Site, according to DEFRA's MAGIC[15] website.

SSE Hornsea Limited holds a licence to abstract groundwater from the underlying Rowe Chalk bedrock aquifer for the rewatering (filling) of underground cavities (Ref. NE/026/0033/011). This licence has a maximum abstraction rate of 500,000m^3/year (not exceeding 40 l/s). It is understood that no potable groundwater abstractions are recorded within 500 m of the Proposed Development. This will be confirmed on receipt of further baseline data in the form of an environmental database search and consultation with ERYC and the Environment Agency.

7.3.3 Key Sensitivities

Key sensitive receptors located in proximity to the Proposed Development include:

- Human Health (onsite construction / operational workers and offsite residential / commercial site users). The nearest residential receptor is a farmhouse located adjacent to the Proposed Development boundary and further residential properties located approximately 300 m to the west of the Proposed Development boundary;
- Agricultural soil within the Proposed Development boundary, classified as Grade 3 ('good to moderate') and Grade 2 ('very good');
- Drainage ditches and watercourses adjacent to the Proposed Development;
- Managing coastal change;
- Secondary superficial (Glacial Till and Alluvium) and Principal bedrock (Rowe and Flamborough Chalk Formation) Aquifers underlying the Proposed Development; and
- Bail Wood Ancient Woodland and Priority Habitat is located approximately 300 m west of the Proposed Development.

Refinement of receptors requiring assessment will be reviewed during the EIA process as more detailed information is obtained from baseline surveys for this topic and other relevant EIA topics, and where appropriate, in response to stakeholder engagement.

7.4 Project Basis for Scoping Assessment

The geology and ground conditions scoping assessment is based on the following aspects:

[15] DEFRA (2022) *Magic Map Application*. Available online: https://magic.defra.gov.uk/magicmap.aspx

- Soils and geology will be exposed to impacts within the temporary construction and permanent surface infrastructure footprints, noting that the locations and extents of activities will be refined as the design progress;
- During the operational phase of the above-ground elements of the Proposed Development (i.e. electrolyser and OCGT) storage and handling of hazardous materials (e.g. fuels, lubricants, stored chemicals), and process liquids, e.g., brine, anti-freezing agents) may be undertaken, as well as periodic maintenance activities which may involve ground disturbance. It is anticipated that maintenance activities on below-ground elements of the Proposed Development (i.e. existing caverns and pipelines) will be minimal;
- Decommissioning will generally be the reverse of the construction sequence and will involve the complete removal of the surface infrastructure, the rewatering of the salt cavities and reinstatement of the storage facility to a suitable condition for future development; and
- Inputs from other topics regarding inter-related effects on human health, water environment and ecological receptors are also considered.

The basis for the assessment also includes embedded mitigation where appropriate, which will influence the magnitude and / or the likelihood of an impact.

7.5 Mitigation

Mitigation measures will be presented to avoid, minimise or reduce adverse impacts. The requirement of additional measures will be dependent on the significance of the effects on geology and ground conditions and will be consulted upon with statutory organisations during the EIA process.

Based on the assessment of the baseline and the identification of any potential impacts, the ES will make clear commitments to the mitigation measures to be employed by contractors, including measures to be adopted should any previously unidentified contamination be encountered during the construction phase.

7.6 Likely Significant Effects to be considered in the EIA

Table **7-1** below is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, and distinguishes between the level of assessment proposed for significant effects scoped in. The basis for scoping out certain effects is presented after the table, supported by the evidence base.

Table 7-1 Likely Effects – Geology and Ground Conditions

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Sterilisation of future mineral resources (construction and operational phases)	N/A	No likely significant effects. The Proposed Development is not located within or near to designated minerals safeguarding areas.	Scoped Out. Effects avoided; no further assessment required. See Section 7.7.1.	N/A
Damage to designated geological SSSI and/or RIGS (construction phase)	Where practical geological SSSIs and RIGS will be avoided by the permanent project footprint.	No likely significant effects. The Proposed Development is not located within or near to a designated geological SSSI or RIGS.	Scoped Out. Effects avoided; no further assessment required.	N/A

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
			See Section 7.7.1.	
Exposure of workforce to health impacts (construction and operational phases)	Ground investigation will likely be undertaken prior to construction (in addition to site investigation data already available) to identify potential contamination and implement mitigation accordingly. Potential risks to human health from any encountered (unexpected) ground contamination will be avoided using appropriate Personal Protective Equipment (PPE) and by adopting appropriate working practices.	No likely significant effects. Any pathways between receptor and source will be avoided through pre-construction mitigation measures and/or use of PPE.	Scoped Out. Protective measures will be outlined in a Code of Construction Practice (CoCP). See Section 7.7.2.	N/A
Encountering contamination during intrusive works (construction phase construction activities and operational phase maintenance activities)	Areas of potential contamination may exist (to be assessed via site investigation and/or review of available data prior to construction), which will be avoided if practicable. Any contamination encountered during the construction phase will be subject to appropriate risk assessment and if necessary, either removed, treated and/or mitigated as part of the Proposed Development.	Likely significant effects without mitigation. Whilst the majority of the site is agricultural land there is the potential for localised contamination to exist due to the historic and current land use. Construction activities (or subsequent maintenance works involving ground disturbance during operation) could disturb contaminants, which could result in impacts on soil / land use, and pollution of surface water and groundwater.	Scoped In. Further assessment involving site walkover and baseline review of potential sources, pathways and receptors. This will feed into the development of a risk-based approach to managing potential contaminated soils during all aspects of construction and operational maintenance activities involving ground disturbance.	Baseline data review to include identification of geology, hydrogeology and potential sources of contamination. Data sources to include BGS data, Landmark Envirocheck report, Local Authority data, and available site investigation reports.
Soil compaction and changes to current drainage and water infiltration to ground (construction phase)	Post-construction the working area will be reinstated to pre-existing condition as far as reasonably practical in line with DEFRA 2009 Construction Code of Practice for the Sustainable Use of	No likely significant effects. Standard industry practices for the protection of top and subsoils during construction and their reinstatement post construction will avoid compaction impacts.	Scoped Out. No further assessment required. Vulnerable soils and their locations, including their protective and reinstatement	N/A

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
	Soils on Construction Sites PB13298.		measures, will be described in a soils management plan, or similar, as part of the CoCP. See Section 7.7.3.	
Dewatering of trenches and excavations (construction phase and operational phase maintenance activities)	Excavations (e.g. for foundations during construction, and potentially during future operational phase maintenance activities) are likely to require dewatering. Temporary treatment of water will be considered in the CoCP to reduce the sediment load and any contamination prior to discharge into an approved water course.	Potentially significant effects without mitigation. If required, dewatering perched water or groundwater could reduce groundwater flow and affect water quality and base flow of local watercourses and abstractions.	Scoped In. Further assessment involving survey, where necessary, and baseline review together with development of location-specific mitigation.	Baseline data review to include identification of hydrogeology. Data sources to include BGS data, Envirocheck data, Local Authority data, and available site investigation reports.
Physical intrusion into groundwater resource (construction phase, e.g. installation of foundations)	Any contamination encountered during the construction phase will be subject to appropriate risk assessment and if necessary, either removed, treated and/ or mitigated as part of the project.	Likely significant effects without mitigation. Drilling fluids and formation waters in pile holes may also escape into the surface or sub-surface environments.	Scoped In. Further assessment involving baseline review of potential sources, pathways and receptors.	Baseline data review to include identification of geology, hydrogeology and potential sources of contamination. Data sources to include BGS data, Envirocheck data, Local Authority data, and available site investigation reports.
Accidental leaks and spills (construction and operational phases)	Standard construction and drilling industry practices will be adopted to mitigate potential impacts on soil quality from accidental spills or leaks.	No likely significant effects. Whilst there are potential contaminative sources from accidental spills (fuels, lubricants, stored chemicals, and process liquids, e.g., brine, anti-freezing agents) introduced by the construction and operation, embedded mitigation will be in place to avoid significant effects.	Scoped Out. No further assessment required. The CoCP will outline preventative measures and contingency plans during construction. Appropriate environmental management procedures will be followed during	N/A

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
			the operational phase. See Section 7.7.4.	
Damage to the coastline and impacts on coastal erosion (construction phase)	N/A	No likely significant effects. Minor refurbishment to the existing discharge pipe located onshore is anticipated and shall avoid any changes to the current coastal erosion regime.	Scoped Out. No further assessment required. The CoCP will outline preventative measures and contingency plans during construction.	N/A

7.7 Effects Scoped out of the EIA

The following sections detail the impacts that have been scoped out of the assessment (see **Table 7-1,** above), together with the basis for doing so. While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

7.7.1 Sterilisation of future mineral resources and damage to designated geological SSSIs/RIGS during construction and operation

No nationally designated geological SSSIs or ERYC-designated RIGS have been identified within 1 km of the Proposed Development. In addition, the ERYC Joint Minerals Local Plan (2019) does not identify any mineral safeguarding areas within the vicinity of the Proposed Development.

7.7.2 Exposure to workforce health impacts during construction

Site investigation data will be reviewed prior to construction to characterise the material likely to be encountered and used to inform a CoCP. However, there remains the potential that during construction-related activities, specifically groundworks including trenching and excavations, that construction workers could encounter unexpected or unknown sources of contamination. Such intrusive activities can create a pathway between the source (the contaminated material, soil or water in question) and the receptor (the construction worker), which may be in the form of dermal contact, inhalation or from digestion. Standard good practice mitigation measures will be incorporated, including adequate and correct use of PPE during these activities. These measures will create a necessary barrier between the source and receptor, and result in a ‘negligible’ impact. Furthermore, should unexpected contamination be encountered during construction; a thorough risk assessment would be conducted, and appropriate measures taken to protect human health and the environment.

7.7.3 Soil compaction and changes to current drainage and water infiltration to ground during construction

In areas subject to vehicle and heavy plant movement, the topsoil and subsoil will be stripped and stored on site within the temporary working areas. The topsoil and subsoil will be stored in separate stockpiles in line with DEFRA’s 2009 Construction Code of Practice for the Sustainable Use of Soils

on Construction Sites PB13298[16]. Post-construction, these working areas will be reinstated to pre-existing condition as far as reasonably practicable. Taking into consideration that the site includes areas currently subject to agricultural activity, including ploughing and other heavy machinery movements, or is part of the existing SSE Hornsea facility, the potential for compaction effects with mitigation in place is minimal.

7.7.4 Potential contamination of the ground and groundwater from accidental leaks and spillages

During both the construction and operational phase, potential leaks and spills may occur from a number of project scenarios including from refuelling machinery / vehicles, from tanks and pipe work, which contain oils / fuels, and from hazardous substance stores (containing fuels, oils and chemicals). In the event of a spill or leak, this would affect local ground conditions and potentially groundwater quality underlying the area. However, embedded mitigation measures will significantly reduce potential impacts by following specific prevention and containment measures such as the following:

- Refuelling of machinery will be undertaken within designated areas where spillages can be easily contained.
- Machinery will be routinely checked to ensure it is in good working condition.
- Any tanks and associated pipe work containing oils and fuels will be double skinned and provided with intermediate leak detection equipment.
- Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores will be bunded and carefully sited to minimise the risk of hazardous substances entering the drainage system or the local watercourses.
- The bunded areas will have impermeable bases to limit the potential for migration of contaminants into groundwater following any leakage/spillage.
- Bunds will be designed to have a 110% capacity.
- Construction materials will be managed in such a way as to effectively minimise the risk posed to the aquatic environment.
- All plant machinery and vehicles will be maintained in a good condition to reduce the risk of fuel leaks.

7.8 Proposed Approach to the Assessment

7.8.1 Baseline

The assessment will consider potential effects on geology, land and water resources (groundwater and surface water) and related designated sites. Surface water quality will also be considered in the Water Resources and Flood Risk assessment (see Section 8).

A Phase 1 desk-based assessment will be completed to identify potential contaminative sources, the presence and nature of potential pathways and receptors (including human receptors, ecological receptors and natural resources, such as groundwater, surface water courses and designated sites) to develop a conceptual site model (CSM).

Additional baseline information will be collated as part of the Phase 1 assessment to allow the baseline CSM to be developed. Site-specific data will be reviewed including a general search of the area using an environmental database (e.g., Landmark Envirocheck report). A targeted walkover of the area may also be undertaken as part of further baseline assessment.

[16] DEFRA (2009) *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf

The Envirocheck report will include up to date datasets (on site and within 1 km of the Proposed Development) on the following key areas, which will build on existing knowledge:

- historic land use (historical mapping and aerial imagery).
- industrial land use and permits for industrial processes.
- sensitive land use and designated sites (ecology, hydrology, hydrogeology etc.).
- recorded pollution incidents; and
- licensed landfill and waste management facilities.

An assessment of potential impacts on existing ground conditions and will be undertaken as part of the EIA, including the potential for the Proposed Development to result in land contamination, as defined in the Environment Act 1995 Part 2A.

Consultation with ERYC and other relevant statutory and non-statutory organisations will be undertaken as necessary. This will include the local Planning Officer and Contaminated Land Officer, who can hold pertinent information and local experience of the surrounding area that may not be in the public domain.

Further site-specific ground investigation surveys (including a groundwater monitoring regime) for geological/geotechnical assessment are likely to be undertaken by the applicant or their appointed designers during the Pre-FEED and FEED stages of the project. Any pertinent geological, hydrogeological and ground contamination information collected during further ground investigation can be used to inform the baseline.

7.8.2 Specific Methodologies

The potential impacts for this topic are characterised on the basis of the potential harm to a receptor within a given source-pathway-receptor combination or pollutant linkage and graded with a level of magnitude.

In order to evaluate whether the presence of a source of contamination could potentially lead to harmful consequences, a source-pathway-receptor methodology is adopted with the underlying principle that the identification of pollutant linkages consists of the following three elements:

- a source hazard (a substance or situation that has the potential to cause harm or pollution);
- a pathway (a means by which the hazard moves along); and
- a receptor/target (an entity that is vulnerable to the potential adverse effects of the hazard).

Land contamination may be a hazard, but it does not constitute a risk unless all three elements, and therefore a pollutant linkage, are present. In assessing the potential for contamination to cause a significant effect, the extent and nature of the potential source or sources of contamination must be assessed, any pathways present must be identified, and sensitive receptors or resources identified and appraised. This will result in the determination of their value and sensitivity to contamination related impacts.

7.8.3 Assessment Criteria

The sensitivity of potential receptors can be described qualitatively according to the categories presented in **Table 7-2.**

Table 7-2 Receptor Sensitivity

Sensitivity	Receptor
High	Human health: onsite residential developments, onsite construction workers Controlled waters (groundwater): Source Protection Zone or Highly productive aquifer Controlled waters (surface water): High ecological status Ecology: Site of national or international importance e.g., SSSI, SAC, SPA or RAMSAR Site Agriculture: Presence of best and most versatile land (Grades 1, 2,3a) Conventionally farmed intensive arable cropping or intensive livestock systems (e.g., dairy cattle)
Medium	Human health: onsite commercial developments, offsite residential developments Controlled waters (groundwater): Moderately productive aquifer Controlled waters (surface water): Good or moderate ecological status. Ecology: Site of regional/local importance e.g., Local nature reserve Agriculture: Presence of land of moderate quality (Grade 3b) Conventionally farmed mixed cropping and livestock systems of moderate intensity
Low	Human health: transient or limited access, off site commercial development Controlled waters (groundwater) Low productivity aquifer or rocks essentially with no groundwater Controlled waters (surface water): Poor ecological status Ecology: No designation Agriculture: Presence of land of poor quality (Grade 4) Conventionally farmed extensive livestock systems or agricultural land in non-agricultural use.

The magnitude of impacts will be determined by considering the intensity (or scale), spatial coverage and longevity of an impact. The magnitude assigned will also use professional judgement to take into consideration the application of statutory standards and non-statutory standards or guidelines. The magnitude of impact on the receptors is presented in **Table 7-3**

Table 7-3 Magnitude of Impact

Impact Magnitude	Description	Example
Large	Results in loss of attribute and/or likely to cause exceedance of statutory objectives and/or breach of legislation High degree of disruption to cultivation patterns and with high risk of change in land use.	Contamination of a highly productive aquifer, or loss or isolation of strategic mineral resource. Impact of the health of a large number of human receptors, including off-site.
Medium	Results in impact on integrity of attribute/or loss of part of attribute, and/or possibly cause exceedance of statutory objectives and/or breach of legislation Moderate degree of disruption to cultivation patterns with moderate risk of change in land use.	Reduction in the value of a feature, loss or isolation of regional/local mineral resource. Impact on the health of on-site human receptors (i.e. the workforce).
Small	Results in minor impacts on receptor Minimal degree of disruption to cultivation patterns and low risk of change in land use	Measurable change in receptor, but of limited size/proportion
Negligible	No loss or alteration of characteristics, features or elements, no observable impact in either direction Minimal or no disruption to cultivation patterns and very low risk of change in land use	No significant loss in quality of receptor

The significance of effect is determined by assessing the potential magnitude of impact on the receptors against the sensitivity of the receptor. Table 7-4 presents the matrix showing the significance of effects. Moderate or major effects are considered significant in EIA terms.

Table 7-4 Significance of Effect

Receptor Sensitivity	Magnitude of Impact			
	Negligible	Small	Medium	Large
High	Not significant	Moderate adverse – significant	Moderate adverse – significant	Major adverse - significant
Medium	Not significant	Minor adverse – not significant	Moderate adverse – significant	Moderate adverse – significant
Low	Not significant	Not significant	Minor adverse – not significant	Minor adverse – not significant

8. WATER RESOURCES AND FLOOD RISK

8.1 Introduction

This section of the Scoping Report identifies the water resources and flood risk interests of relevance to the Proposed Development upon the hydrological environment. It considers the potential effects from construction, operation and maintenance and decommissioning activities of the Proposed Development.

8.2 Topic-specific Regulatory Requirements and Guidance

The assessment will be undertaken in line with the following policy and guidance:

- Water Framework Directive (2000/60/EC)[17] as implemented in England via the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003[18];
- EU Directive 2008/105/EC on environmental quality standards in the field of water policy (the Priority Substances Directive)19;
- EU Directive 2007/60/EC on the Assessment and Management of Flood Risks (the Floods Directive)[20];
- The Water Act 2014[21];
- Water Resources Act 1991 (as amended) Section 85[22];
- Environmental Protection Act 1990[23];
- Flood and Water Management Act 2010[24];
- The Bathing Water Directive (2006/7/EC)[25] as implemented by the Bathing Water Regulations 2013;
- Flood and Water Management Act 2010[26];
- Land Drainage Act 1991[27];

[17] European Parliament (2000) *Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy* ("The Water Framework Directive"). Available online at: http://ec.europa.eu/environment/water/water-framework/index_en.html
[18] UK Government (2003) *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003*. Available online at: https://www.legislation.gov.uk/uksi/2003/3242/contents/made
[19] European Parliament (2008) *Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council*. Available online at: https://eur-lex.europa.eu/eli/dir/2008/105/oj
[20] European Parliament (2007) *Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks*. Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32007L0060
[21] UK Government (2014) *Water Act 2014*. Available online at: https://www.legislation.gov.uk/ukpga/2014/21/contents/enacted
[22] UK Government (1991) *Water Resource Act 1991*. Available online at: https://www.legislation.gov.uk/ukpga/1991/57/contents
[23] UK Government (1990) *Environmental Protection Act 1990*. Available online at: https://www.legislation.gov.uk/ukpga/1990/43/contents
[24] UK Government (2010) *Flood and Water Management Act 2010*. Available online at: https://www.legislation.gov.uk/ukpga/2010/29/contents
[25] European Union (2006) *Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC*. Available online at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0007
[26] UK Government (2010) *Flood and Water Management Act 2010*. Available online at: https://www.legislation.gov.uk/ukpga/2010/29/contents
[27] UK Government (1991) *Land Drainage Act 1991*. Available online at: https://www.legislation.gov.uk/ukpga/1991/59/contents

- British Standard Code of Practice for Earthworks BS 6031 2009[28];
- The Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C741) (2015)[29];
- CIRIA Control of Water Pollution from Construction Sites (C532) (2001)[30]; and
- EA Pollution Prevention Guidelines (PPGs)[31] and General Pollution Plans (GPPs), whilst archived, give advice on statutory responsibilities and good environmental practice.

8.3 Baseline Environment

8.3.1 Data Sources used in Scoping

The date used for the assessment is as follows:

- The Ordnance Survey (OS) 1:50,000 (Digital) and OS 1:25,000 Map (Digital);
- EA Flood map for planning[32];
- EA Catchment Data Explorer[33];
- Internal Drainage Boards (IDB) Map[34];
- DEFRA Magic Map[35]; and
- Atkins Aldbrough Hydrogen Storage Project Feasibility Study Report [36].

8.3.2 Description

As part of the desk-based baseline assessment of Water Resources and Flood Risk for the Proposed Development, data will be analysed in relation to the following processes and parameters:

- surface water receptors in relation to water quality, quantity and hydrological processes;
- water resources including public and private water supplies, and licenced abstractions and discharges; and
- designated sites.

Surface Water

The East Newton Drain flows from east to west across the southern boundary of the Proposed Development Site. The Cess Drain passes along the western boundary of the site and joins the Bail Drain west of the B1242 road. There is a storm water pond on the southern boundary of the Proposed Development.

[28] The British Standards Institute (BSI) (2009). *BS 6031:2009 Code of Practice for Earthworks*. Available online: https://knowledge.bsigroup.com/products/code-of-practice-for-earthworks/standard
[29] CIRIA (2015) C741 *Environmental good practice on site guide. 4th edition*. Available online: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductcode=C741&Category=BOOK
[30] CIRIA (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors (C532)*. Available online at: https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C532&Category=BOOK
[31] NetRegs (2022) *Guidance for Pollution Prevention (GPP) documents*. Available online at: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/
[32] Environment Agency (2021) *Flood Map for Planning*. Available online at: https://flood-map-for-planning.service.gov.uk/
[33] Environment Agency (2022) *Catchment Data Explorer*. Available online at: https://environment.data.gov.uk/catchment-planning/
[34] Association of Drainage Authorities (2022) *Internal Drainage Boards Map*. Available online at: https://www.ada.org.uk/idb-map/
[35] DEFRA (2022) *Magic Map Application*. Available online at: https://magic.defra.gov.uk/magicmap.aspx
[36] Atkins (2022) Aldbrough Hydrogen Storage Project Feasibility Study Report

No surface water abstractions were identified within 2km of the Site.

The eastern half of the Site lies within the area of the South Holderness Internal Drainage Board (IDB)[37].

The Site lies within the Humbleton Beck catchment[38], which has a moderate ecological status based on EA mapping, largely due to agricultural pressures and sewage discharge and is also regarded as a Nitrate Vulnerable Zone (NVZ). Its chemical status is 'fail' due to the presence of mercury and its compounds, and polybrominated diphenyl ethers (PBDE). The catchment lies within the wider Humber River Basin District. The North Sea coast is classified as the Yorkshire South coastal waterbody with a classification of Moderate Ecological Status however a chemical status of fail due to the presence of mercury and its compounds, PBDE, benzo(g,h,i)perylene and tributyltin compounds.

Flood Risk

The Groundsure report shows moderate groundwater flood risk for the wider site boundary area, with areas of high and moderate-high risk in the northwest of the site within the zone proposed for surface development, see **Figure 8-1**.

The highest risk of surface water flooding (because of extreme rainfall events) across the site is recorded as 3.3% chance in any given year and is on the western boundary of the site associated with the local drainage ditches. In addition, a spring is noted on the Groundsure report to the north-east of the site in proximity to Ringbrough Farm.

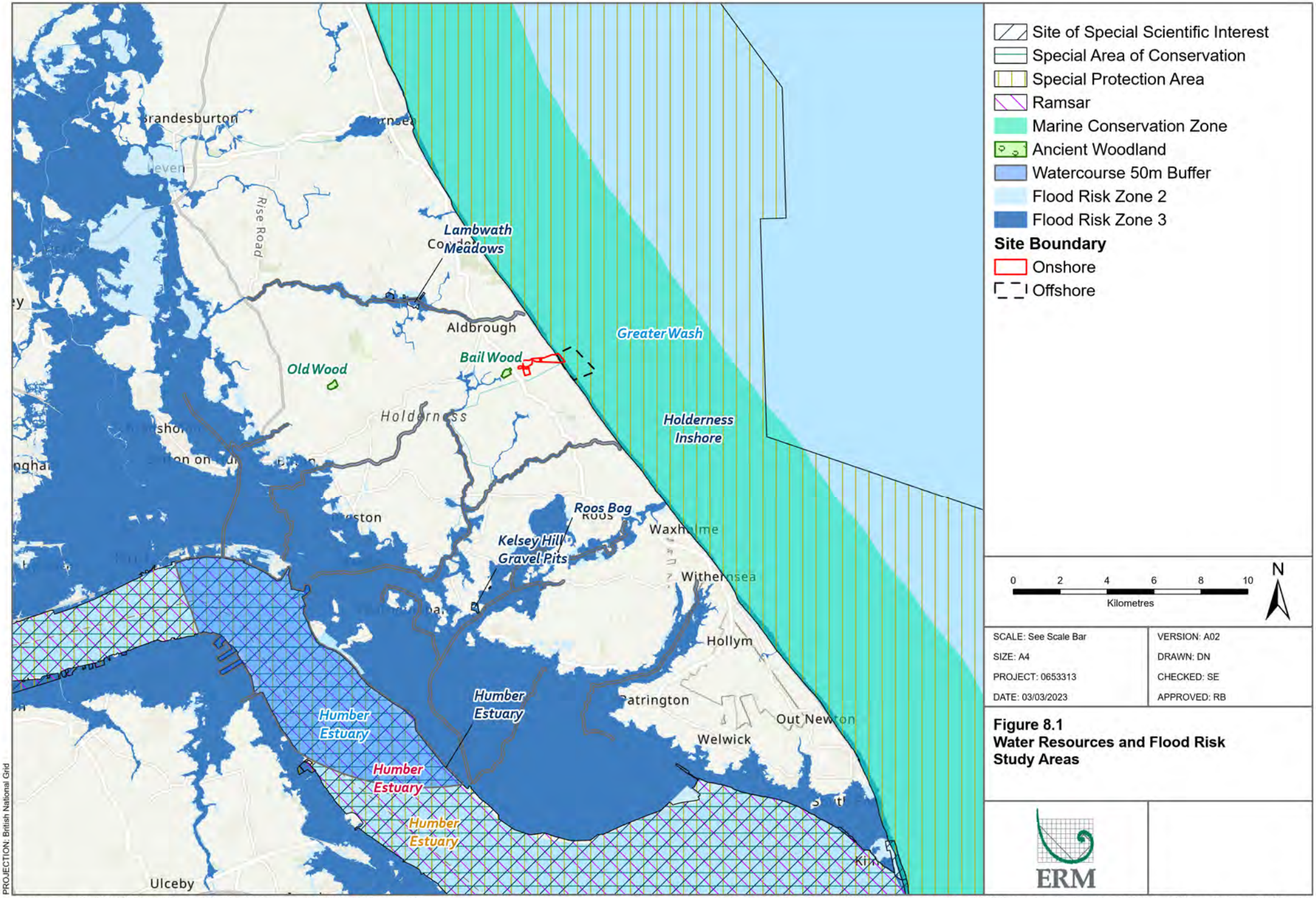
The EA Flood Map for Planning indicates that the Site is within Flood Zone 1[39]. This means the Site is at very low risk from flooding from rivers or the sea with a chance of flooding from this source of less than 0.1% in any given year. The EA Flood Map for surface water shows that the eastern section of the site is at very low risk from flooding from surface water. The western section of the site has a low risk, between 0.1% and 1% chance in any given year, of flooding from surface water. A small part of the western section close to the field drains has a high risk of surface water flooding, with the chance of flooding from surface water greater than 3.3% in any given year. The EA flood map for surface water does not include the mitigation of existing surface water infrastructure at the site.

The Site is not at risk of flooding from reservoirs.

[37] South Holderness Internal Drainage Board (2022) *Map 'Keyingham 5'*. Available online at: https://www.southholdernessidb.co.uk/maps.html

[38] Environment Agency (2022) *Humbleton Beck Catchment Water Body*. Available online at: https://environment.data.gov.uk/catchment-planning/WaterBody/GB104026066610

[39] Environment Agency (2022) *Flood Map for Planning*. Available online at: https://flood-map-for-planning.service.gov.uk/flood-zone-results?easting=525970&northing=436939&location=aldbrough&fullName=%2520&recipientemail=%2520


Site of Special Scientific Interest
Special Area of Conservation
Special Protection Area
Ramsar
Marine Conservation Zone
Ancient Woodland
Watercourse 50m Buffer
Flood Risk Zone 2
Flood Risk Zone 3
Site Boundary
Onshore
Offshore
Lambwath Meadows
Aldbrough
Greater Wash
Bail Wood
Old Wood
Holderness
Holderness Inshore
Roos Bog
Kelsey Hill Gravel Pits
Waxholme
Withernsea
Hollym
Patrington
Out Newton
Welwick
Humber Estuary
Ulceby
Rise Road
0 2 4 6 8 10
Kilometres
N
SCALE: See Scale Bar
SIZE: A4
PROJECT: 0653313
DATE: 03/03/2023
VERSION: A02
DRAWN: DN
CHECKED: SE
APPROVED: RB
Figure 8.1
Water Resources and Flood Risk Study Areas
ERM
PROJECTION: British National Grid
Esri, Intermap, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Natural England
Path: \\uksprdgisfs01\Data\London\0653313 - Project Accelerator\Maps\0653313 - Project Accelerator - A01.aprx\0653313 - Pathfinder - HY - Water Risk 10km - A01

Water Resources

As identified in recent studies, there is one known groundwater abstraction from the underlying bedrock aquifer, which is associated with the Site. This abstraction has a licensed maximum annual extraction volume of 500,000 m^3. No potable groundwater abstractions or source protection zones were recorded within 500 m of the Site.

The DEFRA Magic Map[40] viewer shows that the Core Study Area does not lie within a Drinking Water Safeguard Zone for surface water or groundwater.

There is the potential for public and private water supplies to exist within the Water Resources Study area boundary given rural location and the potential agricultural uses. This will be confirmed with the EA and Council to inform the assessment of potential effects.

Designated Sites

There are no designed sites relevant to water resources and flood risk within the site.

8.3.3 Key Sensitivities

The sensitivities of the identified receptors are detailed in Table 8-1.

Table 8-1 Sensitivity of Receptors

Receptor	Sensitivity[41]	Sensitivity Description
Surface Hydrology (watercourses and coastal waterbodies)	Medium	A large, medium, or small waterbody with an EA water quality classification of 'Moderate'; and The hydrological receptor and downstream environment will have some capacity to attenuate natural fluctuations in hydrochemistry but cannot absorb certain changes without fundamentally altering its baseline characteristics / natural processes.
Designated Receptors	High	The hydrological receptor is of high environmental importance or is designated as having national or international importance (Greater Wash SPA and Holderness Inshore Marine Conservation Zone (MCZ)).
Public and Private Water Supplies	To be confirmed	Consultation is required to ascertain the presence of any Private and/or Public Water Supplies.
Licensed abstractions	To be confirmed	Consultation to take place with the Environment Agency and Yorkshire Water to confirm the presence of abstractions.

8.4 Project Basis for Scoping Assessment

The main aspects of the Proposed Development that could lead to impacts on water resources during construction are as follows:

- chemical pollution and sedimentation of watercourses and the wider hydrological environment as a result of construction works, including excavations and piling.
- chemical pollution as a result of fires, leaks or spillages.
- pollution from construction vehicles or plant on site.
- pollution as a result of chemicals from contaminated land being released, as there is potential for runoff/movement of contaminated groundwater into surface waters via storm drains.
- impediments to watercourse from willow and deep foundations (including piling), dewatering and excavation works.

[40] DEFRA (2022) *DEFRA Magic Map*. Available online at: https://magic.defra.gov.uk/magicmap.aspx
[41] Sensitivity class is determined using Table 2: Framework for Determining Importance and Sensitivity of Receptors

- increased run-off and flood risk from new hardstanding areas, including access roads/tracks and construction works; and
- compaction of soils and superficial deposits and reduction in ability of such deposits to store water in relation to flood risk.

Long-term effects from the operational phase could include:

- increased run-off and flood risk from increased hardstanding including permanent access roads, however the need for additional hardstanding is likely to be minimal as it is anticipated that existing hardstanding areas and access road will be utilised.
- pollution risks from operational processes onsite associated with the movement and storage of H_2; and
- pollution from operational traffic (on-site maintenance activities) due to accidental spillages.

Impacts from the above activities will not necessarily lead to significant effects, considering the application of good practices and mitigation measures to be included in design.

8.5 Mitigation

Mitigation measures including those in the design of the facilities, construction practices and operational procedures that have been committed to by the Applicant will be described within both the Water Resources and Flood Risk, and Geology and Ground Conditions sections of the ES. Anticipated mitigation measures typical for a development of these nature are outlined in Table 8-2.

8.6 Likely Significant Effects to be Considered in the EIA

Table 8-2 below is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not. The basis for scoping out certain effects is presented after the table.

The Water Resources and Flood Risk section of the ES will consider the planned activities of the Proposed Development (and where relevant the likelihood of an accidental event occurring) and conclude whether the residual significance will be Major, Moderate, Minor or Not Significant with appropriate mitigation implemented. Major or Moderate effects are significant in terms of the EIA Regulations.

As decommissioning will be more than 25 years in the future it will not be addressed to the same level of detail as the other phases and in general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

It is unlikely that there will be significant effects from the Proposed Development on the hydrological environment with the implementation of the embedded mitigation measures. However, further assessment will confirm this.

Table 8-2 Likely Effects – Water Resources and Flood Risk

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Chemical pollution	Standard good practice measures	Minor – Not significant	Scoped In	Review of embedded mitigation within design Consultation with Environment Agency
Erosion and sedimentation		Minor – Not significant	Scoped In	
Impediments to flow		Minor – Not significant	Scoped In	

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Increased runoff and flood risk	Standard good practice measures. Design of drainage system	Negligible	Scoped In	Environment Agency and Internal Drainage Board (IDB) consultation
Impacts on public and private water supplies (including licensed abstractions and discharges)	Good practice measures outlined within the CEMP Surface Water Quality Monitoring (if required)	Minor – Not significant	Scoped In	Consultation with Yorkshire Water, the Environment Agency and local authority Environmental Health Officer required to confirm presence or absence of abstractions
Impacts on designated sites – impacts from Chemical Pollution and Erosion/ Sedimentation	Good practice measures outlined within the CEMP	Negligible	Scoped Out	Consultation carried out with Natural England (Discretionary Advice Service) to confirm no anticipated significant impacts in relation to water quality through HRA screening.

8.7 Effects Scoped out of the EIA

While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

Impacts on water quality from chemical pollution, erosion, and sedimentation on designated sites (SACs and Marine Coastal Zones (MCZs)) have been scoped out and subsequently screened out of any Habitat Regulations Assessment. This is due to the location of the site adjacent to the coastal area, with active coastal erosion any sediment mobilisation from the site would be minor in comparison and would not to lead to any deterioration of SAC or MCZ because of the Proposed Development.

8.8 Proposed Approach to the Assessment

8.8.1 Baseline

The approach for the Water Resources and Flood Risk section for the Proposed Developed will be based on a source-pathway-receptor methodology, where the sensitivity of the receptors and the magnitude of potential change (impact) upon those receptors is identified within the study area.

A walkover will be carried out to ground-truth hydrological conditions at the Site.

Additionally, consultation with the Environment Agency and Yorkshire Water will take place to identify licensed abstractions in proximity of the Proposed Development, as well as to identify Public and Private Water Supplies that could be impacted by the Proposed Development.

A Flood Risk Assessment (FRA) compliant with the requirements of the NPPF and the National Policy Statement on Flood and Coastal Erosion Risk Management will be undertaken to assess any flood risk.

8.8.2 Assessment Criteria

The sensitivity of the baseline receptors to impacts, together with the importance of environmental features on, or near to, the Site, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

Table 8-3 Details the framework for determining importance of receptors and their sensitivity to adverse impacts from the Proposed Development.

Table 8-3 Framework for Determining Importance and Sensitivity of Receptors

Importance and Sensitivity of Receptor	Definition
High	A large, medium or small waterbody with an EA water quality classification of 'Good' or 'High'. The hydrological receptor and downstream environment has limited capacity to attenuate natural fluctuations in hydrochemistry and cannot absorb further changes without fundamentally altering its baseline characteristics / natural processes. The hydrological receptor will support abstractions for public water supply or private water abstractions for more than 25 people and/ or is used for the mass-production of food and drinks. The hydrological, geological, or geomorphological receptor is of high environmental importance or is designated as having national or international importance, such as Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs). The receptor acts as an active floodplain or other flood defence or is located within an active, undefended flood plain, in accordance with the NPPF or SFRA.
Medium	A large, medium, or small waterbody with an EA water quality classification of 'Moderate'. The hydrological receptor and downstream environment will have moderate capacity to attenuate natural fluctuations in hydrochemistry but cannot absorb certain changes without fundamentally altering its baseline characteristics / natural processes. The hydrological receptor does not act as an active floodplain or other flood defence. The hydrological receptor supports abstractions for public water supply or private water abstractions for up to 25 people. The hydrological receptor is of regional environmental importance (such as Local Nature Reserves), as defined by the EA or NE.
Low	A large, medium or small water body with a EA Quality classification of 'Poor' or 'Bad' and / or a Current Chemical Quality classification of 'Fail'. The hydrological receptor and downstream environment will have capacity to attenuate natural fluctuations in hydrochemistry but can absorb any changes without fundamentally altering its baseline characteristics / natural processes. The hydrological receptor is not of regional, national or international environmental importance. The hydrological receptor is not designated for supporting freshwater ecological interest. The hydrological receptor does not act as an active floodplain or other flood defence. The hydrological receptor is not used for recreational use. The hydrological receptor does not support abstractions for public water supply or private water abstractions.

8.8.3 Magnitude of Impact

The magnitude of potential impacts will be identified through consideration of the Proposed Development activities, the degree of change to baseline conditions it effects, the duration and reversibility of a resultant effect and professional judgement, best practice guidance and legislation.

The criteria for assessing the magnitude of an impact are presented in **Table 8-4**.

Table 8-4 Framework for Determining Magnitude of Impact

Magnitude of Impacts	Definition
Large	A short or long-term major shift in hydrochemistry or hydrological conditions sufficient to negatively change the ecology of the receptor. This change will equate to a downgrading of an EA water quality classification by two classes e.g. from 'High' to 'Moderate'. A sufficient material increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with NPPF 2021 paragraphs 159 to 169); and The yield of existing supplies may be lost or major long-term or short-term reduction in quantity and/ or deterioration in quality.
Medium	A short or long term non-fundamental change to the hydrochemistry or hydrological environment, resulting in a change in ecological status. This change will equate to a downgrading of an EA water quality classification by one class e.g. from 'High' to 'Good.' A moderate increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water The yield of existing supplies may be reduced or quality slightly deteriorated. Fundamental negative changes to local habitats may occur, resulting in impaired functionality.
Small	A detectable non-detrimental change to the baseline hydrochemistry or hydrological environment. This change will not result in a downgrading of the EA water quality classification. A marginal increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with NPPF paragraphs 155 to 165); and/or A detectable but non-material effect on the receptor such that the functionality of the receptor will not be affected in the medium or long term.

8.8.4 Significance of Effect

The importance of the asset, its sensitivity to adverse impacts and the magnitude of the predicted impacts will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. **Table 8-5** summarises guideline criteria for assessing the significance of effects.

Table 8-5: Framework for Assessment of the Significance of Effects

Magnitude of Impact	Sensitivity of Resource or Receptor		
	High	**Medium**	**Low**
Large	Major	Major	Moderate
Medium	Major	Moderate	Minor
Small	Moderate	Minor	Not Significant

Impacts of negligible magnitude will always be considered to lead to an effect which is not significant and are not outlined within the table above. Effects predicted to be of major or moderate significance are 'significant' in the context of the EIA Regulations.

9. NOISE AND VIBRATION

9.1 Introduction

This section addresses noise and vibration, providing a brief overview of existing conditions and the Proposed Development setting, identifies the effects to be considered in the EIA, and details the proposed approach to assessing the effects of the Proposed Development on sensitive receptors.

9.2 Topic-specific Regulatory Requirements and Guidance

The noise and vibration assessment will be carried out within the context of relevant government policy and guidance in England. This includes the Noise Policy Statement for England 2010[42] (NPSE), the NPPF 2021[43], and the Government's planning guidance on noise (PPGN)[44].

The aims of the NPSE are: "*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The explanatory note in the NPSE introduces the following concepts:

- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

The PPGN provides more in-depth guidance to the NPSE. It introduces the additional concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). A summary of the guidance on effect levels from the PPGN on is provided in **Table 9-1**.

Table 9-1 PPGN Guidance on Noise Adverse Effect Levels

Response	Examples of outcomes	Increasing effect level	Action
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep	Observed Adverse Effect	Mitigate and reduce to a minimum

[42] DEFRA (2010) *Noise Policy Statement for England (NPSE)*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

[43] Ministry of Housing, Communities and Local Governments (2021*) National Planning Policy Framework.* Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

[44] Institute of Acoustics (2017) *ProPG: Planning and Noise*. Available online at: https://www.ioa.org.uk/sites/default/files/14720%20ProPG%20Main%20Document.pdf

Response	Examples of outcomes	Increasing effect level	Action
	disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.		
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

9.2.1 Construction and Decommissioning Phases

The following legislation and standards are of particular relevance to noise and vibration generated by the construction and decommissioning phases of the Proposed Development:

- The Control of Pollution Act 1974[45];
- The Environmental Protection Act 1990[46]; and
- BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

The Control of Pollution Act 1974 (CoPA, 1974)

Control of Pollution Act (CoPA) 1974 provides Local Authorities with powers to control noise and vibration from construction sites.

Section 60 of CoPA enables a Local Authority to serve a notice to persons carrying out construction work of its requirements for the control of site noise. This may specify plant or machinery that is or is not to be used; the hours during which construction work may be carried out; the level of noise or vibration that may be emitted; and provide for changes in circumstances. There are also appeal procedures for the persons served notice available.

Section 61 of CoPA allows for those carrying out construction work to apply to the Local Authority in advance for consent to carry out the works. This is not mandatory, but once consent is issued it provides a defence against action by the Local Authority under Section 60 of CoPA 1974 or Section 80 of the Environmental Protection Act (EPA) 1990. It does not, however, prevent nuisance action under Section 82 of the EPA 1990. The application includes detail of the works to be carried out, the methods to be used and the measures that will be taken to minimise noise and vibration.

The Environmental Protection Act 1990 (EPA, 1990)

The EPA 1990 specifies mandatory powers available to Local Authorities in respect of any noise that either constitutes or is likely to cause a statutory nuisance, which is also defined in the Act. A duty is imposed on Local Authorities to carry out inspections to identify statutory nuisances, and to serve

[45] HM Government (1974) *The Control of Pollution Act*. Available online: https://www.legislation.gov.uk/ukpga/1974/40
[46] HM Government (1990) *The Environmental Protection Act*. Available online: https://www.legislation.gov.uk/ukpga/1990/43/contents

abatement notices against these. Procedures are also specified with regards to complaints from persons affected by a statutory nuisance.

BS 5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites

BS 5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites (BS 5228) refers to the need for the protection against noise and vibration of persons living and working in the vicinity of and those working on construction and open sites. It recommends procedures for noise and vibration control in respect of construction activities.

9.2.2 Operational Phase

The following standards are of particular relevance to noise generated by the operational phase of the Proposed Development:

- BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound[47] (BS4142); and
- ISO 9613-2:1996: Attenuation of Sound during Propagation Outdoors[48].

BS 4142 describes methods for rating and assessing sound in order to provide an indication of its likely effect upon nearby dwellings or premises used for residential purposes.

The specific sound level at a noise sensitive receptor (NSR) from the Proposed Development (dB, lAeq) is used to derive a rating level by taking into account both the level and character (i.e., tonal elements, impulsivity, intermittency and distinctiveness) of the sound. This is achieved by applying appropriate corrections to the specific sound level externally at the receptor location, which gives the rating level of the sound in question. This is then assessed against the existing prevailing background sound level (dB, LA90) at that location in order to determine a likely level of effect.

When considering the level of effect, BS 4142 emphasises the importance of the context in which a sound occurs.

9.3 Baseline Environment

9.3.1 Data Sources used in Scoping

Satellite imagery and mapping data from Google Earth have been used to identify baseline receptors and noise sources likely to significantly contribute to the baseline sound environment.

9.3.2 Description

Proposed Development

The nearest NSRs to the Scoping Boundary are the nearby residential properties, with the closest being 300m west of the site opposite the access road. A second residential property is approximately 340m east of the site. There are approximately 160 residential properties within 2 km of the Proposed Development, with the closest town being Aldbrough, approximately 2 km north of the Proposed Development. A number of these residential properties are operational farms which may contribute to baseline noise levels. The nearest identified NSRs are shown in **Figure 9.1**. Their use as assessment locations would, at this stage, be expected to result in a worst-case assessment.

[47] British Standards Institution (2019) *BS 4142 - Noise Assessments and Methods*. Available online at: https://www.bsigroup.com/en-GB/standards/bs-4142/#:~:text=The%20new%20British%20Standard%20BS,loading%20and%20unloading%20of%20goods

[48] ISO (1996) *ISO 9613-2:1996*. Available online at: https://www.iso.org/standard/20649.html#:~:text=Describes%20a%20method%20for%20calculating,ISO%201996)%20under%20meteorological%20conditions

The baseline noise environment is likely to include road traffic noise from the existing road network, which is directly west of the Site, as well as other anthropogenic sources such as farm machinery. Natural sources of noise such as birds, wind in the trees and waves breaking on the coast are also likely to contribute to the baseline noise level.

Noise Sensitive Receptor

Site Boundary

Onshore

Offshore

0 200 400 600 800 1,000

Metres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: DN
PROJECT: 0653313	CHECKED: SE
DATE: 03/03/2023	APPROVED: RB

Figure 9.1
Nearest Identified Noise Sensitive Receptors

ERM

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\0653313 - Project Accelerator\Maps\0653313 - Project Accelerator - A01.aprx\0653313 - Pathfinder - AC - Noise Sensitive Receptors - A01

9.3.3 Key Sensitivities

The key receptors for noise and vibration are the nearby residential properties.

9.4 Project Basis for Scoping Assessment

9.4.1 Construction

During construction, the main sources of noise will be from the following activities:

- Fixed and mobile construction plant used to construct infrastructure within the Proposed Development will generate noise and vibration including installation of the electrolyser and OCGT.
- Night-time construction works at the wellhead (drilling/work overs/cementing of wells) has the potential to result in significant disturbance at nearby properties should they be required for more than a week or two.
- The use of water pumps to transfer water during the rewatering and debriding of the salt caverns may be a continuous operation (i.e., 24 hours a day) but likely to be over a short duration.
- Construction traffic associated with the workforce and the delivery of material and equipment who will use the wider local road network.

9.4.2 Operation

During operation, the main sources of noise will be from fixed plant on-site including:

- Operation of the OCGT and electrolyser and associated plant;
- Activities at the wellhead platform with associated facilities for the cavities; and
- Rare use of the hydrogen vent / flare in the event of maintenance, abnormal conditions or emergencies

Increases in heavy goods vehicle (HGV) movements (including any brine tankering operations, should they be required) have the potential to lead to increases in road traffic noise on local roads and will be assessed.

9.5 Mitigation

9.5.1 Construction

Construction noise will be minimised where practicable, following the guidance set out in Section 8 of BS 5228-1: Code of Practice on Noise Control. BS 5228-1 describes measures to control noise at source including for example:

- substitution of plant or activities by less noisy ones.
- modification of plant or equipment to reduce noise emissions.
- the use of noise control enclosures.
- the siting of equipment and its method of use; and
- equipment maintenance.

BS5228-1 also describes measures for controlling the spread of noise, e.g., by increasing the distance between plant and noise-sensitive receptors or by the provision of acoustic screening.

9.5.2 Operation

Appropriate mitigation will be considered during the EIA. Noise control measures such as choosing low noise versions of equipment, use of acoustic enclosures, noise barriers and bunding, siting equipment and buildings to provide screening will be considered, where practicable, as the design proceeds.

9.6 Likely Significant Effects to be considered in the EIA

Table 9-2 below is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, where appropriate noting actions, including baseline data acquisition, for significant effects scoped in. The basis for scoping out certain effects is presented after the table.

As decommissioning will be approximately 25 years post start of operation it will not be addressed to the same level of detail as the other phases and in general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

Table 9-2 Likely Effects – Noise and Vibration

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction and decommissioning of infrastructure for the Proposed Development including the OCGT and electrolyser	Practicable noise control measures, following the guidance set out in Section 8 of BS 5228-1	Moderate	Scoped In	Day / evening / night baseline measurements
Construction road traffic		Minor	Scoped In	Publicly available traffic data supplemented by traffic counts in some areas
Noise from the operation of the OCGT / electrolyser and associated plant	Noise control measures such as choosing low noise versions equipment, use of acoustic enclosures, noise barriers and bunding, siting equipment and buildings so as to provide screening will be considered, where practicable.	Minor	Scoped In	Day / night baseline measurements
Operation of the wellhead platform		Minor	Scoped In	
Operation of the hydrogen / oxygen vent and flare		Minor	Scoped In	
Operational road traffic including any brine tankering operations, should they be required		Not significant	Scoped In	Publicly available traffic data supplemented by traffic counts in some areas
Vibration from the operation of the	n/a	Not significant	Scoped Out	n/a

Proposed Development				

9.7 Effects Scoped out of the EIA

While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

No significant vibration generating equipment will be required during operation. Therefore, an operational vibration assessment is scoped out.

Noise and vibration effects during decommissioning are expected to be similar to those generated during the construction phase. As such, a separate assessment of decommissioning noise and vibration will not be included.

9.8 Proposed Approach to the Assessment

9.8.1 Baseline

A detailed knowledge of the baseline noise environment is required at the nearest NSRs. Baseline noise levels will be logged for a period of at least one week in accordance with BS 4142, along with meteorological data such as rain and wind speed and direction. Baseline noise measurement locations will be chosen in consultation with the local authority, to be representative of the typical noise environment at the nearest NSRs under assessment. Attended measurements may also be carried out at the same time to supplement the logged noise measurements.

The construction assessment requires a knowledge of the day / evening / night baseline noise environment. Baseline noise levels to inform a construction assessment will make use of the same survey data collected for the operational assessment.

It is understood there are two permanent noise monitoring stations at the Site. It may be possible to use data from these sites, however this will be confirmed at the EIA stage.

Potential road traffic noise effects will be assessed by considering the predicted change in existing traffic flows and therefore the assessment will make reference to baseline traffic flow information from the traffic and transport assessment. Construction traffic routes have not been identified at this stage; however, publicly available traffic data is available for many of the roads local to the site such as the B1242, B1238, A165 and the A1033. This should be sufficient to enable a conservative assessment to be carried out, however, additional traffic counts may be carried out in some areas to supplement this information.

9.8.2 Specific Methodologies

Noise level predictions will be carried out using a computer software package. The widely recognised software package SoundPLAN will be used, implementing the prediction method set out in ISO 9613-2 [49]. Construction noise level predictions would be carried out according to BS 5228-1[50].

9.8.3 Assessment Criteria

The criteria for assessment of noise and vibration effects due to each phase of the Proposed Development will be agreed with ERYC Environmental Health departments, however, it is proposed that the following criteria be adopted for assessment.

[49] ISO (1996) *ISO 9613-2:1996*. Available online at: https://www.iso.org/standard/20649.html

[50] British Standard Institution (2009) *BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites. Noise (+A1:2014)*. Available online at: https://www.thenbs.com/PublicationIndex/documents/details?Pub=BSI&DocID=305965

Construction and Decommissioning Phases

Construction noise will be assessed using BS 5228-1, with reference to the 'ABC method'. The ABC method defines thresholds at building facades on the basis of existing noise levels as set out in **Table 9-3.** Where forecast construction noise exceeds the relevant threshold, this would be an indicator of a potentially significant effect and would be adopted as the LOAEL assessment criteria (as defined in **Table 9-3.**

For daytime, the widely used threshold of 75 dB lAeq (category C) being exceeded for one month or more would be taken to be the SOAEL for construction noise. The threshold was originally set to avoid interference with normal speech indoors, with windows closed (Wilson, 1963[51]). The daytime SOAEL and the corresponding SOAELs for the evening and night periods (shown in **Table 9-3**), indicate likely significant effects on health and quality of life at a receptor, assuming construction noise is dominant and of sufficient duration.

Table 9-3 Airborne Sound from Construction – Impact Criteria at Residential Receptors

Period	Assessment Category dB lAeq, T		
	A	B	C
	LOAEL (A or B category depending on baseline noise level)		SOAEL
Day: T=12hr, Weekdays, 07:00-19:00, T=6hr, Saturday, 07:00-13:00	>65	>70	>75
Evenings and weekends: T=period time stated below, Weekdays 19:00–23:00, Saturdays 13:00-23:00, Sundays 07:00-23:00	>55	>60	>65
Night: T=8 hr, Every day 23:00-07:00	>45	>50	>55

Notes:
All sound levels are defined at the façade of the receptor.
Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values.
Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values.
Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values.

Where predicted noise levels are above LOAEL thresholds, but below the SOAEL, other factors would be taken into account in determining whether, in EIA terms, the effect could be significant, such as the duration of the activity causing the noise impact. This process is summarised in Table 9-4.

Table 9-4 Magnitude and Significance of Construction Noise Effects

Exceedance of criteria, dB	Magnitude of predicted impact		Significance of effect
5 or more below the criteria	Negligible	Factors which may influence significance of effects, e.g. duration of construction activity	Not significant
> 5 below, up to the criteria	Small		Minor
Up to 5 dB above the criteria	Medium		Moderate
> 5 above the criteria	Large		Major

Construction traffic noise has been predicted in terms of the Basic Noise Level (BNL), according to Calculation of Road Traffic Noise (CRTN). Traffic noise magnitudes are assessed as Negligible for noise changes less than 1 dB(A), and Small for changes between 1.0 and 2.9 dB, with medium

[51] Committee on the Problem of Noise (Wilson Committee) (1963) *Noise*.

changes between 3.0 and 4.9 dB and Large changes above 4.9 dB based on the guidance in the Design Manual for Roads and Bridges (DMRB). If construction traffic noise is above a small magnitude, the effect would be considered significant if it lasted for at least 10 or more days or nights in any 15 consecutive days or nights.

Operational Phase

The potential for significant noise effects will be assessed according to BS 4142. BS 4142 sets out guidance used for the assessment of sound of an industrial and/or commercial nature. The methods described in BS 4142 use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling used for residential purposes.

BS 4142 defines several terms which are referred to in this assessment. They are listed below.

- Specific sound level, Ls ($L_{Aeq,Tr}$): the sound level of the noise source being assessed;
- Rating level, $L_{Ar,Tr}$: the specific sound level plus any adjustment for characteristic features of the sound;
- Ambient sound, La ($L_{Aeq,T}$): the overall sound level from all sources, usually composed of sound from many sources near and far;
- Residual sound level, Lr ($L_{Aeq,T}$): the sound level remaining when the specific sound level is sufficiently suppressed so as not to contribute to the ambient sound level; and
- Background sound level ($L_{A90,T}$): the L_{90} statistical measure of the residual sound level. The background sound level is an underlying level of sound over a period, T. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

Initial Assessment

BS 4142 includes an assessment of the difference between the background sound level and the rating level at the receptor. This is referred to as the 'initial assessment'.

As described above, the rating level is equal to the specific sound level plus any adjustment for characteristic features of the sound. BS 4142 states "*Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level*."

The following acoustic features are described in the standard:

- tonality: up to a +6 dB penalty.
- impulsivity: up to a +9 dB penalty (if necessary, this can be summed with the tonality penalty);
- intermittency: a +3 dB penalty; and
- other sound characteristics (neither tonal nor impulsive but still distinctive): a +3 dB penalty.

Consideration of Context

Following the initial assessment, BS 4142 requires consideration of the context in which the sound occurs when determining the significance of the impact. BS 4142 states "*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context*."

Where the initial estimate of the impact needs to be modified due to the context, various pertinent factors need to be considered, including:

- the absolute level of sound.
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

Table 9-5 summarises the criteria for the magnitude and significance of potential effects as well as the LOAEL and SOAEL values.

Table 9-5 Criteria Defining the Magnitude and Significance of Potential Effects from Fixed Plant

Noise Rating level (1), IAr,Tr	BS 4142 Extract Regarding the Initial Assessment	Magnitude	Factors which may affect Significance (from BS 4142)	Significance of Noise
<= background (2)	The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.	Negligible	Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including: ■ the absolute level of sound. ■ the character and level of the residual sound compared to the character and level of the specific sound; and ■ the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.	Not significant
> background (2) up to background (2) + 5dB		Small		Above LOAEL, but below SOAEL
> background (2) + 5dB up to background (2) + 10dB	A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.	Medium		
> background (2) + 10dB	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context	Large		Significant – above SOAEL

Rating Level, IAr,Tr according to BS 4142. The specific sound level corrected to allow for certain distinctive acoustic features.
Background Sound Level according to BS 4142. The measured L90 level in the absence of the specific level.

Operational traffic noise has been predicted in terms of the BNL, according to CRTN. Traffic noise magnitudes are assessed as Negligible for noise changes less than 1 dB(A), and Small for changes between 1.0 and 2.9 dB, with medium changes between 3.0 and 4.9 dB and large changes above 4.9 dB based on the guidance in the DMRB. If traffic noise is above a small magnitude, the effect would be considered significant.

10. AIR QUALITY

10.1 Introduction

This section identifies the potential effects on ambient air quality from construction, operation (including maintenance) and, where relevant, decommissioning activities of the Proposed Development.

At the construction phase the principal pollutants of interest are dust and particulate matter (as PM_{10}), due to construction activities and nitrogen dioxide (NO_2) from construction traffic. During the operational phase the principal impact of interest will be associated with:

- emissions from the operation of the OCGT: oxides of nitrogen (NO_x) emissions from combustion and, if an SCR abatement system proves necessary, the ammonia (NH_3) slip to the atmosphere;
- emissions from flaring of hydrogen (e.g. safe shut-down, emergency and maintenance): oxides of nitrogen (NO_x) emissions from combustion.

The principal pollutants of interest for the operational phase are therefore:

- NO_2 with regards to human health impacts;
- NO_x and NH_3 and associated nutrient nitrogen and acid depositions with regards to impacts on habitat sites.

10.2 Topic-specific Regulatory Requirements and Guidance

This scoping section has been prepared following the relevant guidance, and published documents and considering applicable standards:

- Environment Agency, Air emissions risk assessment for your environmental permit[52];
- Environment Agency (2014) AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air.
- Air Quality Standards imposed in UK law (The Air Quality Standards Regulations 2010 Statutory Instrument 2008/301, transposed from EU standards (European Union Air Quality Standards[53]); and
- Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, Version 1.1[54].

10.3 Baseline Environment

10.3.1 Data Sources used in Scoping

The following data sources were used for the air quality baseline:

- DEFRA online interactive monitoring networks map[55];
- DEFRA's online UK Ambient Air Quality Interactive Map[56];

[52] Environment Agency (2022) *Air emissions risk assessment for your environmental permit.* Available online: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screen-out-insignificant-pecs
[53] http://ec.europa.eu/environment/air/quality/standards.htm
[54] https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf
[55] DEFRA (2022) *Interactive Monitoring Networks Map*. Available at: https://uk-air.defra.gov.uk/interactive-map
[56] DEFRA (2022) *Ambient Air Quality*. Available at: https://uk-air.defra.gov.uk/

- DEFRA's online Air Quality Management Area Interactive Map[57]; and
- local authority monitoring data [58].

10.3.2 Description

The Proposed Development is not located within an Air Quality Management Area (AQMA)[59], however traffic accessing the site might go through the AQMA on the A63 in Hull. AQMAs are declared in areas where air quality standards are not currently achieved. UK DEFRA 2020 background maps for the Scoping Boundary show:

- annual mean PM_{10} levels below 20 µg/m^3 (UK air quality standard is 40 µg/m^3) with parts of this area below 13 µg/m^3;
- annual mean NO_x levels below 20 µg/m^3 (UK air quality standard is 30 µg/m^3) with parts of this area below 10 µg/m^3;
- annual mean NO_2 levels below 20 µg/m^3 (UK air quality standard is 40 µg/m^3) with large parts of this area below 10 µg/m^3; and
- dust baseline is not monitored, but similar to PM_{10} is expected to be well below nuisance thresholds.

Local authority monitoring for NO_2 occurs with diffusion tubes at:

- George and Dragon PH Aldbrough (kerbside): 14.7 µg/m^3 annual mean in 2021;
- 31 Main Street Preston (kerbside): 23.1 µg/m^3 annual mean in 2021;
- 6 Glencoe Villas, Hull Road, Hedon (roadside): 21.2 µg/m^3 average over 2018-2021; and
- The Limes, Staithes Road Preston (kerbside): 17.8 µg/m^3 average over 2018-2021.

Background levels of NO_x and NH_3 and nutrient nitrogen and acid depositions at designated ecological sites will be obtained from the Air Pollution Information System (APIS)[60].

10.3.3 Key Sensitivities

The Proposed Development is located in a rural area. There are no AQMAs within the East Riding of Yorkshire local authority area, however traffic accessing the site might go through the AQMA on the A63 in Hull and there are several habitat sites within 15 km of the OCGT.

The key sensitivities will be:

- potential dust nuisance for residential areas within 500 m from construction activities and 200 m from construction access routes.
- potential PM_{10} health impacts for sensitive receptors (schools, hospitals, nurseries, care homes, residential areas) within 500 m from construction activities and 200 m from construction access routes.
- potential impacts to human health (NO_2) and designated ecological sites (NO_x and NH_3 and associated nutrient nitrogen and acid depositions) along with their Areas of Search (AoS):
  - SAC, SPA, Ramsar sites and SSSI within 15 km of the Site; and

[57] DEFRA (2022) *AQMA Map*. Available online: https://uk-air.defra.gov.uk/aqma/maps/
[58] East Riding of Yorkshire Council (2022) *Air Quality Monitoring in East Riding of Yorkshire*. Available online: https://eastriding.maps.arcgis.com/apps/webappviewer/index.html?id=2cd47837a1e34b8da43424f5071ea55c
[59] DEFRA (2020) *UK Air: Air Information Resource*. Available online: https://uk-air.defra.gov.uk/aqma/maps/
[60] Air Pollution Information System (2022) Available online: http://www.apis.ac.uk/srcl/select-a-site?SiteType=SAC&submit=Next

- NNR, LNR, Sites of Importance for Nature Conservation (SINC) and ancient woodland within 2 km of the Site.

10.4 Project Basis for Scoping Assessment

The air quality scoping assessment is based on the following:

- the temporary and permanent Proposed Development footprints presented in section 3.3 plus an additional 500m buffer for dust raising impacts.
- the likely nature, location and extent of the construction activities as outlined in Section 3.3; and
- the likely nature of operational activities as outlined in Section 3.4.1

The methodology used to assess impacts for the:

- construction phase of the Proposed Development is based on IAQM guidance (see Section 10.5);
- operational phase of the Proposed Development is based on EA guidance[61] as mentioned in Section 10.1. The assessment will consider different emission scenarios based on:
  - mix of hydrogen/natural gas used as fuel.
  - application of SCR and associated ammonia emissions.
  - flaring regime.

The sensitivity of human receptors within the radius of potential impacts from dust raising (500m from construction activities and 200 m from access roads), is to be considered high for all types of receptors (residential areas, schools, hospitals etc.) within the framework of the dust impact assessment.

For other types of impact, residential areas are considered to be of medium sensitivity. High sensitivity applies to hospitals and schools.

The sensitivity of a designated ecological site is specific to the site itself and accounted for in site specific critical loads and levels for the species present. Of important note is that background levels in UK of nutrient nitrogen especially tend to be elevated and, in some cases, exceed the critical loads already, thereby reducing the available 'headroom' for new projects. This is specifically pertinent to the use of SCR as the associated ammonia slip in general has a larger impact to depositions than the NO_x which it reduces.

The basis for assessment also includes the embedded mitigation (e.g. Low NOx combustion technology, SCR) where appropriate.

10.5 Mitigation

As part of the Proposed Development design process, it is expected and considered best practice to reduce the potential for impacts due to emissions of dust from construction activities in line with the IAQM Guidance document. Adhering to this guidance in general makes it possible to render these impacts negligible, or at worst small.

The impacts of the OCGT with regards to NOx emissions will be function of the mix of hydrogen/natural gas that will be used as fuel, low NOx combustion technologies, combustion optimisation, advanced control systems and the application of SCR, if necessary.

The impacts of hydrogen flaring with regards to NOx emissions will be a function of flaring duration, frequency and volume.

[61] Environment Agency (2022) *Air emissions risk assessment for your environmental permit.* Available online: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screen-out-insignificant-pecs

Where significant impacts are identified, additional mitigation will be explored through discussion with the Proposed Development process engineers. This additional mitigation may include but is not limited to process-integrated measures to reduce emissions at source or improvement of dispersion (increased stack height or exit temperature) conditions, Residual impacts including additional mitigation will be assessed using the methodology mentioned in Section 10.3. Impacts to designated sites if they can't be screened out will need detailed assessment through Appropriate Assessment.

It is assumed that a vent system will be used for the venting of oxygen and hydrogen to support events such as periodic depressurisation of hydrogen systems, to allow a safe shutdown for routine and emergency situations, as well as to prevent the accumulation of a hazardous atmosphere within the plant, which is mostly of concern for short term impacts. Most appropriate mitigation for emergency venting is limited to reducing the number of events which is inherent for this type of activity. It is worth noting that vented hydrogen and oxygen has no implications to air quality or human health, and that hydrogen venting is therefore scoped out for air quality impact assessment.

10.6 Likely Significant Effects to be considered in the EIA

Table 10-1 below is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, where appropriate noting actions, including baseline data acquisition, for significant effects scoped in. The basis for scoping out certain effects is presented after the table.

As decommissioning shall be approximately 25 years post start of operation, it will not be addressed to the same level of detail as the other phases and in general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

Table 10-1 Likely Effects – Air Quality

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction works associated with dust raising activities (earthworks, traffic on unpaved areas, construction works). This may have an effect on human and ecological receptors sensitive to dust and PM_{10}.	In line with IAQM guidance.	Minor at most. Embedded mitigation, for example as set out by the IAQM, is designed to reduce impact levels to negligible or at worst minor impacts, considering distance to and sensitivity of receptors.	Scoped In	None
Operation of the Proposed Development.	It is possible that SCR will be applied to reduce NO_x emissions. The associated ammonia slip however in general has a larger impact to designated sites than the NO_x which it reduces. Hydrogen flaring will be associated with NOx emissions. Embedded mitigation is limited to	Minor to moderate at most for human health with the application of SCR. Impacts to designated sites may however need further assessment through Appropriate Assessment procedure.	Scoped In	None

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
	minimising frequency, volume and duration of flaring.			
Construction, operational and decommissioning related traffic will be associated with emissions of dust and exhaust gases, which may affect human and ecological receptors.	None required	Not significant. The maximum increase of HGV movements over any one route is expected to be less than 25 Annual Average Daily Traffic (AADT) and the maximum number of LDV movements is expected to be less than 100 AADT (threshold cfr. guidance provided by the UK Highways Agency[62]) and IAQM) Guidance.	Scoped In	None
Decommissioning activities will generally be the reverse of the construction sequence, involving similar types and numbers of vessels and equipment.	In line with IAQM guidance	Minor at most. Embedded mitigation, for example as set out by the IAQM, is designed to reduce impact levels to negligible or at worst minor impacts, considering distance to and sensitivity of receptors.	Scoped In	None

10.7 Effects Scoped out of the EIA

All activities have been scoped in.

10.8 Proposed Approach to the Assessment

10.8.1 Baseline

Baseline air quality data (PM_{10}, NO_x/NO_2, NH_3, nutrient nitrogen and acid depositions) will be sourced (see Section 10.3) from national or local monitoring networks, and modelling undertaken by local authorities where available and from national modelling outputs (background mapping, APIS). No baseline surveys will be undertaken.

[62] Highways England et al (2019) *Design Manual for Roads and Bridges: LA 105 Air Quality*. Available online. https://www.standardsforhighways.co.uk/prod/attachments/10191621-07df-44a3-892e-c1d5c7a28d90

10.8.2 Specific Methodologies

Impacts from construction activities, if scoped in, will be assessed semi-quantitatively using the methodology described in the IAQM guidance.

Impacts associated with the OCGT and hydrogen flaring will be assessed quantitatively using dispersion modelling and as per the EA guidance[63].

The approach to the assessment of potential impacts of air emissions on sites designated for their national and local ecological importance will follow the guidance produced by DEFRA / Environment Agency on screening risks from emissions to air on protected areas for nature conservation.

This process follows the Habitat Regulations Assessment (HRA) process by initially Screening to identify the likely effects of a project on a nationally or locally designated site for nature conservation and considering whether there are likely to be adverse effects.

10.8.3 Assessment Criteria

The Air Quality Standards of relevance for this assessment are set out in following **Table 10-2**. Critical levels (for the effects of NO_x and NH_3) have been assessed against environmental standards that apply either across all habitat types (for NO_x), or across lichens/bryophytes and vascular plants (for NH_3).

Table 10-2 Applicable Air Quality Standards

Applicability	Compound	Averaging period	Assessment Criterion (µg/m3)	Percentile
Sensitive Human Receptor	PM_{10}	Annual, mean	40	n/a
		24 hour, <36 exceedances yearly	50	90.14th
	NO_2	Annual, mean	40	n/a
		1-hour, <18 exceedances yearly	200	99.79th
	NH_3	Annual, mean	180	n/a
		1-hour, maximum	2 500	100th
Ecological receptor	Nitrogen oxides (NO_x)	Annual	30	n/a
		Daily (24hr mean)	75/200*	100th
	Ammonia (NH_3)	Annual	1 – where lichens / bryophytes are present	n/a
		Annual	3 – for all other vegetation	n/a

n/a = not applicable

* 200 µg/m^3 is applicable where ozone is below the AOT40[64] critical level and sulphur dioxide is below the lower critical level of 10 µg/m^3

[63] Environment Agency (2022) *Air emissions risk assessment for your environmental permit.* Available online: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screen-out-insignificant-pecs

[64] Sum of the differences between hourly ozone concentration and 40 ppb for each hour when the concentration exceeds 40 ppb during a relevant growing season, e.g. for forest and crops

The critical loads[65] for deposition for each habitat type will be obtained from APIS and used as tools to assess the potential for effects of air compounds on habitats.

The assessment criteria to determine impacts from construction activities are described in the IAQM guidance.

Based upon Environment Agency Guidance[66], the assessment of atmospheric emissions for the operational phase considers:

- the Process Contribution (PC), i.e. the predicted contribution to the concentration of a specific compound in ambient air from the plant emissions themselves; and
- the Predicted Environmental Concentration (PEC), which is the PC added to the background concentration of the specific compound.
- The significance of the impacts for human health is determined cfr. the IAQM guidance for planning[67] as specified in **Table 10-3** below.

Table 10-3 Significance framework for impacts to human health

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

The screening approach to determine whether the PCs for designated sites are insignificant, or require further assessment, will be undertaken by comparing the PCs (and where necessary PECs), against the percentages of the critical levels / loads for each habitat as set out in the DEFRA / EA guidance (see following table).

The approach will also consider the contribution of the Site along with other projects and plans as part of an in-combination assessment.

Table 10-4 Assessment Criteria for Habitats and Species for National Sites

Criterion	Assessment
Long Term / Short Term	
PC < 1% of CL (long) and / or PC <10% of CL (short) or PC > 1% of CL (long) and / or >10% of CL (short) but PEC < 70% of CL	Insignificant contribution and no further assessment required. Considered in the assessment to have no likely significant effect.
PC > 1% of CL (long) and / or >10% of CL (short)	Cannot be considered as an insignificant contribution. Further assessment is required to determine the effects on habitats and species and

[65] Critical Loads are defined as: *"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"* (http://www.apis.ac.uk/critical-loads-and-critical-levels-guide-data-provided-apis)

[66] Environment Agency (2022) *Air emissions risk assessment for your environmental permit.* Available online: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screen-out-insignificant-pecs

[67] https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf

and PEC > 70% of CL	whether, or not, they are likely to have an adverse effect on the integrity of a designated site.

For local sites, the PC is deemed insignificant if it is less than 100% of CL (short and long term).

11. TRAFFIC AND TRANSPORT

11.1 Introduction

This section of the Scoping Report addresses the traffic and transport resources within the study area. The section provides a brief overview of existing conditions and the Proposed Development setting, identifies the potential effects to be considered in the EIA, and details the proposed approach to assessing the effects of the Proposed Development on sensitive receptors.

11.2 Topic-specific Regulatory Requirements and Guidance

The traffic and transport assessment will, where relevant, be undertaken in accordance with guidance contained in the following planning policy documents (but not limited to):

- NPPF 2021[68]
- The Institute of Environmental Management and Assessment ("IEMA", 1993), 'Guidelines for the Environmental Assessment of Road Traffic';
- Department for Transport Circular 02/2013: The Strategic Road Network and the Delivery of Sustainable Development[69];
- Planning Practise Guidance on Travel Plan, Transport Assessment and Statements[70]; and
- East Riding of Yorkshire Local Transport Plan Strategy 2021 - 2039[71].

11.3 Baseline Environment

11.3.1 Data Sources used in Scoping

A desk study has been undertaken to obtain information on traffic and transport infrastructure within the general study area. The following data sources of information were consulted:

- Ordinance Survey and mapping data from Google Earth.
- Department of Transport Traffic Counts Website.
- ERYC Public Right of Way Map; and
- Sustrans Website.

11.3.2 Description

Access to the wider area from the Strategic Road Network is mainly available via the B1242 and B1238 which provide wider connectivity to the A165 and A1033. Access to the Proposed Development is available from the B1242 Aldbrough Road to the west, providing connectivity to the B1238 (Hull Road) and wider connectivity to the A165. The access to the Site is currently used to access Aldbrough Phase1.

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[68] Ministry of Housing, Communities and Local Governments (2021*) National Planning Policy Framework.* Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

[69] Department for Transport (2013) *Circular 02/203 Update*. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1093964/circular-02-2013-update.pdf

[70] Ministry of Housing, Communities and Local Government (2014) *Planning Practise Guidance on Travel Plan, Transport Assessment and Statements*. Available online: https://www.gov.uk/guidance/travel-plans-transport-assessments-and-statements

[71] East Riding of Yorkshire Council (2021) *East Riding of Yorkshire Local Transport Plan Strategy 2021 – 2039* Available online: https://www.eastriding.gov.uk/council/plans-and-policies/other-plans-and-policies-information/transport/local-transport-plan/

As part of Aldbrough Phase 1, a designated haulage route for construction and operational vehicles over 3 tonnes was approved. This approved route included the provision of a link road to prevent construction vehicle movements routing through the village of Aldbrough. Assuming that traffic is travelling from Hull, the approved route for heavy goods vehicles (HGVs) is along the A165, the B1238 through Bilton and Sproatley and then using the link road to access the Proposed Development via the B1242. It is anticipated that this established route would be utilised by the Proposed Development.

11.3.3 Key Sensitivities

The following sensitive receptors have been identified and will be considered within the EIA:

- motorised users of the surrounding highway network, including vehicle drivers and public transport users; and
- non-motorised users of the surrounding highway network, Public Right of Way (PRoW) and non-designated public routes including pedestrians, cyclists, ad equestrians (and vulnerable groups).

11.4 Project Basis for Scoping Assessment

The traffic and transport scoping assessment are based on the following:

- the construction activities outlined in Section 3.5.1 which will generate traffic movements (including potential tankering of brine off site during the conversion of the ALD1 cavern) on the highway network (including the Strategic Road Network), including the transportation of abnormal loads associated with the delivery of various components for the Proposed Development.
- generation of traffic during operation affecting the highway network (including the Strategic Road Network); and
- generation of traffic during decommissioning affecting the highway network (including the Strategic Road Network).

11.5 Mitigation

The Traffic and Transport ES section will provide details of proposed mitigation where appropriate. This is likely to be set out in specific plans including the following:

- a Construction Worker Travel Plan which is likely to be required to promote sustainable journeys during the construction phase of the Proposed Development and where possible reduce single occupant car journeys.
- a Construction Traffic Management Plan (CTMP) is likely to be required to consider options to mitigate the impact of the construction phase and associated traffic including tankering of water off site; and
- an Operational Traffic Management Plan (OTMP), if one is required, to mitigate the impact of the operational phase and associated traffic including tankering water off site, otherwise an Operational Worker Travel Plan.

Further discussions will be required with National Highways and ERYC regarding mitigation proposals in order to ensure that they are acceptable.

11.6 Likely Significant Effects to be considered in the EIA

Table 11-1 below is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, where appropriate noting actions, including baseline data acquisition, for significant effects scoped in. The basis for scoping out certain effects is presented after the table.

As decommissioning shall be approximately 25 years post start of operation, it will not be addressed to the same level of detail as the other phases and in general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

Table 11-1 Likely Effects – Traffic and Transport

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Road Safety – Construction phase	Good practice measures outlined within the CTMP	Likely significant	Scoped In - A detailed assessment will be undertaken including collision analysis of all parts of the road network significantly affected by construction traffic.	Accident data for road links within the study area.
Driver Delay – Construction phase	Good practice measures outlined within the CTMP	Likely significant	Scoped In - A detailed quantitative assessment will be undertaken using data collected for the Proposed Development and surveys to determine the level of effect.	New traffic flow data for roads and junctions within the study area.
Pedestrian/Cycle Amenity – Construction and drilling phase	Good practice measures outlined within the CTMP	Likely significant	Scoped In – An assessment will be undertaken to identify affected footways/cycle ways, pRoW affected by the construction works	New traffic flow data for roads and junctions within the study area
Increase in Traffic Flows (including potential tankering of brine offsite) – Construction phase	Good practice measures outlined within the CTMP	Likely significant	Scoped In - A detailed quantitative assessment will be undertaken using data collected for the Proposed Development and surveys to determine the level of effect.	New traffic flow data for roads and junctions within the study area
Severance – Construction phase	Good practice measures outlined within the CTMP	Likely significant	Scoped In - A detailed quantitative assessment will be undertaken using data collected for the Proposed Development and surveys to determine the level of effect	New traffic flow data for roads and junctions within the study area
Abnormal Indivisible Loads – Construction phase	Good practice measures outlined within the Abnormal Load Route Assessment	Likely Significant	Scoped In - A detailed assessment will be undertaken including a full review of the abnormal load route from the Port of Entry (PoE) for critical structure dimensions/ capability.	Details of the various component for the storage facilities; Mapping for the swept path analysis

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
			Swept path analysis of key junctions, bends and other constraints on the route.	
Hazardous Loads - Construction phase	N/A	Not likely significant	Scoped Out	N/A
Air Quality – Construction phase	N/A	Not likely significant	Scoped Out - The need for an assessment of the impact of construction traffic on air quality will be considered as part of the Air Quality assessment (Section 10).	N/A
Noise – Construction phase	Practicable noise control measures, following appropriate guidance (See Section 9)	Not likely significant	Scoped Out - The need for an assessment of the impact of construction traffic on noise will be considered as part of the Noise and Vibration assessment (Section 9).	N/A
Impact from traffic generation Operational phase (Proposed Development)	Good practice measures outlined within the OTMP	Likely significant	Scoped In – Likely significant effects will be similar to environmental impacts during construction phase and will be assessed. It is anticipated that further assessment will demonstrate operational environmental impacts are negligible and will have no significant effects on sensitive receptors, and a proportional assessment can be undertaken.	New traffic flow data for roads and junctions within the study area
Decommissioning	N/A	Likely significant	Scoped Out - It is not possible to accurately forecast baseline traffic flow levels at the time of decommissioning. For this reason, further work would be undertaken at the time of decommissioning to determine if significant transport effects might be experienced.	N/A

11.7 Effects Scoped out of the EIA

While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

11.7.1 Noise

Environmental impacts arising from HGV movements will include vibration, noise, and highway safety risks, however these will be temporary during the construction phase and when the site is operational would have a negligible highway impact. It is anticipated that traffic associated with the construction and operational phase of the Proposed Development is likely to have an impact on noise and vibration and its impact will be considered separately as part of the noise and vibration assessment (see Section 9). Therefore, it is proposed that assessment of noise and vibration, because of road traffic, is scoped out of the traffic and transport assessment.

11.7.2 Air Quality

Current guidance on matters relating to air quality advises that significant effects on people due to impacts on local air quality may be found in the following cases:

- where the road alignment will change by 5 m or more: or
- daily traffic flows will change by 1,000 AADT flow or more; or
- Heavy Duty Vehicle flows will increase by 200 AADT or more; or
- daily average speed will change by 10 km/hr or more: or
- peak hour speed will change by 20 km/hr or more.

Given that the assessment of the expected volume of construction traffic, it is anticipated that none of the above criteria will be breached or exceeded. In addition, the Proposed Development is not located in an Air Quality Management Area, and due to the temporary nature of the increase in vehicles using the proposed access route during construction, any effects on local air quality will be short term and reversible.

Operational traffic numbers will be very small. The need for an assessment of the impact of construction traffic on air quality will be considered as part of the air quality assessment (see Section 10. It is proposed that assessment of operational traffic impacts on air quality is scoped out of the traffic and transport assessment.

11.7.3 Hazardous Loads

Fuel will be regularly transported over the duration of construction of the Proposed Development. All fuel will be transported by suitably qualified contractors, and all regulations for the transportation and storage of hazardous substances will be observed. No other hazardous substances in significant quantities are expected to be transported for the Proposed Development. Therefore, the assessment of the impact of transporting hazardous loads during the construction phase has been scoped out of this assessment.

11.7.4 Decommissioning

Impacts during decommissioning are anticipated to be less than those during construction and installation since drilling will not be involved. It is anticipated that the Proposed Development will be operational for 25 years. It is not possible to accurately forecast baseline traffic flow at the time of decommissioning. For this reason, further work would be undertaken at the time of decommissioning to determine if significant transport effects might be experienced.

11.8 Proposed Approach to the Assessment

11.8.1 Baseline

Baseline traffic flow conditions on routes within the study area will be established. ERYC (the Local Highway Authority), and National Highways (the Strategic Highway Authority) will be consulted to accurately define the traffic and transport study area and the extent of any traffic survey data required for the EIA. However, it is anticipated to include key junctions along the proposed haulage route and assessed as part of the construction of the Proposed Development.

Due to the impact of the recent pandemic on travel, data from publicly available traffic flow information may not be acceptable and therefore new traffic counts should be undertaken for affected roads and junctions within study the area. This is likely to be in the form of Automatic Traffic Counters on key links/crossings and junction turn counts at key junctions or where new or temporary junction are formed. Baseline traffic data will be factored to account for traffic growth between the date of recording and the anticipated date of peak construction.

Personal Injury Accidents data will be obtained from ERYC (and Humberside Police) to inform the baseline assessment.

11.8.2 Specific Methodologies

The assessment methodology will be based on the IEMA (1993) guidelines. A screening process, using two broad rules from these guidelines, will be employed to identify roads on which potential significant effects may occur.

- Roads where traffic is predicted to increase by more than 30% a result of the Proposed Development, or where the number of HGVs is predicted to increase by more than 30% must be assessed.
- Roads in specifically sensitive areas where overall traffic flow or HGVs are predicted to increase by more than 10% must be assessed.

Where the predicted increase in traffic flow is lower than these thresholds, the significance of the effects can be considered to be low or not significant with no further detailed assessments warranted. Consequently, where the predicted increase in traffic flow is greater than these thresholds, the potential effects are considered to be significant and are assessed in greater detail.

The IEMA (1993) guidelines are intended for the assessment of environmental effects of road traffic associated with major new developments giving rise to traffic generation, as opposed to short-term construction. In the absence of alternative guidance and as the traffic generation during the operational phase is very low, these guidelines have been applied to assess the short-term construction phase of the Proposed Development.

Where existing traffic levels are generally low (e.g., rural roads and some unclassified roads), any increase in traffic flow may result in a predicted increase that would be higher than the IEMA (1993) guideline thresholds. In these situations, it is important to consider any increase in terms of overall traffic flow in relation to the capacity of the road, before making a conclusion on whether the effect is significant as defined under the EIA Regulations.

Any change in traffic flow which is greater than the thresholds set out in the IEMA (1993) guidelines will be subject to further analysis. The magnitude of potential impacts will be identified through consideration of receptor sensitivity against the degree of predicted change to baseline conditions, the duration and reversibility of this change and professional judgement.

It is not proposed to submit a formal Transport Assessment (TA) to accompany the planning application for the Proposed Development, as TAs principally relate to developments that generate a significant permanent increase in traffic as a direct consequence of function (e.g., retail parks). Traffic associated with the operational phase of the Proposed Development is anticipated to be below the

required threshold for a formal TA. It is anticipated that further assessment in addition to consultation with National Highways and ERYC will demonstrate that a formal TA is unlikely to be required.

11.8.3 Assessment Criteria

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Site or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement. Table 11-2 details the framework for determining the sensitivity of receptors.

Table 11-2 Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
Very High	The receptor has no ability to absorb change without profoundly altering its present character, is of high strategic value, or of national importance, would include receptors such as populated urban areas where existing traffic levels are high and there is no capacity to absorb additional traffic flow on adjacent routes; and strategic nationally important routes with no capacity to absorb additional traffic flow
High	Receptors of substantial sensitivity, would include: People whose livelihood depends upon unrestricted movement within their environment including commercial drivers and companies who employ them, residents, schools, and colleges. Accident hotspots would also be considered.
Medium	Receptors with sensitivity, would include: People who pass through the area habitually, but whose livelihood is not wholly dependent on free access. Would also typically include congested junctions, community services, parks, businesses with roadside frontage, and recreation facilities.
Low	Receptors with some sensitivity, would include: People who occasionally use the road network. Would also typically include public open spaces, nature conservation areas, listed buildings, tourist attractions, residential roads with adequate footway provision and places of worship
Negligible	Receptors with very low sensitivity, would include: People not sensitive to transport effects. Would also refer to receptors that are sufficiently distant from the affected roads and junctions

11.8.4 Magnitude of Change

The magnitude of potential change is a function of the existing volumes of traffic and will be identified through consideration of the Proposed Development, the percentage increase and degree of change to baseline conditions predicted as a result of the Proposed Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

The criteria for assessing the magnitude of change on those receptors described above are presented in Table 11-3

Table 11-3 Framework for Determining the Magnitude of Change

Type of Impact	Magnitude of Change			
	Negligible	Small	Medium	Large
Severance	Change in total traffic flow of <30%	Change in total traffic flow of 30% to 60%	Change in total traffic flow of 60% to 90%	Change in total traffic flow of >90%
Pedestrian Amenity	Change in traffic flow (or HGV component) <50%	Change in traffic flow (or HGV component) of 50% to 100%	Change in traffic flow (or HGV component) of 100% to 150%	Change in traffic flow (or HGV component) of 150%

Type of Impact	Magnitude of Change			
	Negligible	Small	Medium	Large
Fear and intimidation	Change in total traffic flow of <30%	Change in total traffic flow of 30% to 60%	Change in total traffic flow of 60% to 90%	Change in total traffic flow of >90%
Highway Safety	Change in total traffic flow of <10%	Magnitude of impact derived using professional judgment informed by the frequency and severity of collisions within the study area and the forecast increase in traffic		
Driver Delay	Change in total traffic flow of <30%	Magnitude of impact derived using professional judgment informed by the increase in vehicle delay and whether a junction is at, or close to capacity		

11.8.5 Significance of Effect

Table 11-4 summarises guideline criteria for assessing the significance of effects. The sensitivity of the receptor and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects by considering both the sensitivity of the receptors and magnitude of change as shown in Table 11-3

Table 11-4 Framework for the Assessment of the Significant of Effects

Magnitude of Change	Sensitivity of Receptor				
	Very High	High	Medium	Low	Negligible
Large	Major	Major	Moderate	Moderate	Minor – Not Significant
Medium	Major	Moderate	Moderate	Minor – Not Significant	Not Significant
Small	Moderate	Moderate	Minor – Not Significant	Not Significant	Not Significant
Negligible	Minor – Not Significant	Minor - Not Significant	Not Significant	Not Significant	Not Significant

Effects predicted to be of major or moderate significance are considered to be ‘significant’ in the context of the EIA Regulations, whilst minor effects are considered ‘not significant’.

11.8.6 Abnormal Load Assessment

An Abnormal Load Route Assessment (ALRA) will be undertaken to confirm that the proposed designated haulage route can accommodate Abnormal Indivisible Loads (AILs) and that their transportation will not have any detrimental effect on the proposed route and will identify any additional off-site improvement works which are required to make the route viable.

12. ECOLOGY AND NATURE CONSERVATION

12.1 Introduction

This section outlines the ecology and nature conservation receptors and details the proposed approach to assessing the potential effects of the Proposed Development on sensitive ecological receptors. Both onshore and offshore ornithology are covered in this section, however offshore ecology does not fall within the jurisdiction of this Scoping Report, rather it is subject to a separate EIA process under The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended).

12.2 Topic-specific Regulatory Requirements and Guidance

The assessment will be undertaken with consideration of relevant regulatory requirements and guidance including the following:

- Directive 2009/147/EC on the Conservation of Wild Birds ('Birds Directive')[72];
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) ('Habitats Directive')[73];
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (as amended) ('Habitat Regulations')[74];
- The Wildlife and Countryside Act 1981 (as amended)[75];
- The Natural Environment and Rural Communities (NERC) Act 2006[76];
- Environnemental Impact Assessment Directive 2014/52/EU[77];
- UK Post-2010 Biodiversity Framework (2012)[78];
- NPPF[79];
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Chartered Institute of Ecology and Environmental Management (CIEEM),2019[80];

72 European Parliament (2009) *The Birds Directive*. Available online: https://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

73 European Parliament (1992) *The Habitats Directive*. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN

74 HM Government (2019) *The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019*. Available online: https://www.legislation.gov.uk/ukdsi/2019/9780111179512/contents

75 HM Government (1981) *The Wildlife and Countryside Act 1981 (as amended)*. Available online: http://www.legislation.gov.uk/ukpga/1981/69

76 HM Government (2006) *Natural Environment and Rural Communities Act 2006*. Available online: http://www.legislation.gov.uk/ukpga/2006/16/contents

77 European Parliament (2014) *Directive 2014/52/EU Amending the EIA Directive*. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN

78 Four Countries' Biodiversity Group (2010) *UK Post-2010 Biodiversity Framework*. Available online: http://data.jncc.gov.uk/data/587024ff-864f-4d1d-a669-f38cb448abdc/UK-Post2010-Biodiversity-Framework2012.pdf

79 HM Government (2021) *National Policy Planning Framework.* Available online: https://www.gov.uk/government/publications/national-planning-policy-framework—2

80 CIEEM (2019) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition.* Chartered Institute of Ecology and Environmental Management, Winchester

- East Riding Local Plan[81];
- East Riding of Yorkshire Biodiversity Action Plan[82]; and
- Birds of Conservation Concern (BoCC) 5: the population status of birds in the United Kingdom, Channel Islands, and Isle of Man[83].

12.3 Baseline Environment

12.3.1 Data Sources used in Scoping

- Ordnance Survey mapping;
- Natural England's Multi Agency Geographic Information for the Countryside (MAGIC);
- North and East Yorkshire Ecological Data Centre;
- Google Earth (for context only); and
- NBN Gateway (for context only).

12.3.2 Description

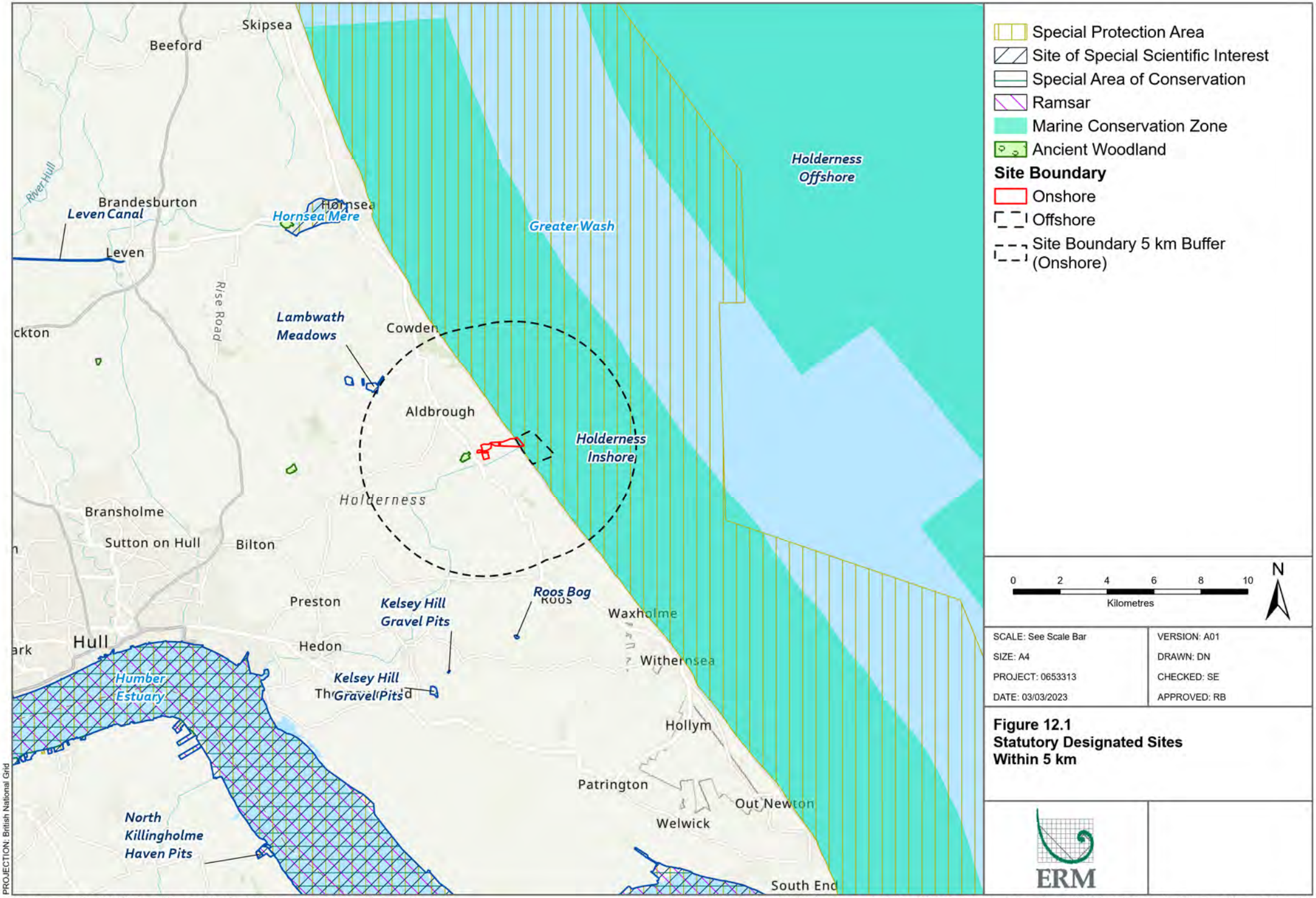
Statutory Designated Sites

There are three International/European and national statutory designated sites within 5 km of the Proposed Development. There are no Special Areas of Conservation (SACs) with bats as qualifying features within 30 km of the Proposed Development. The full list of statutory designated sites, together with a brief description of their interest features is given in **Table 12-1** and presented on **Figure 12.1**.

81 East Riding of Yorkshire Council (2016) *East Riding Local Plan.* Available online: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/east-riding-local-plan/

82 East Riding of Yorkshire Council (2010) *East Riding of Yorkshire Biodiversity Action Plan Strategy*. Available online: https://www.eastriding.gov.uk/EasySiteWeb/GatewayLink.aspx?alId=105217

83 Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D. and Win, I. (2021) *The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain.* British Birds 114, 723–747



SCALE: See Scale Bar	VERSION: A01
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DATE: 03/03/2023	APPROVED: RB

Figure 12.1
Statutory Designated Sites Within 5 km

ERM

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\0653313 - Project Accelerator\Maps\0653313 - Project Accelerator - A01.aprx\0653313 - Pathfinder - EC - Environmental Constraints 5km - A01

Non-Statutory Designated Sites

Bail Wood Ancient Woodland is located approximately 310 m west of the Proposed Development. The Humbleton Local Wildlife Site (LWS) is located 1.2 km east of the Proposed Development. Further details are provided in Table 12-1

Table 12-1 Statutory and non-statutory sites within 5km of the Proposed Development

Designated Site	Distance from AHP Project	Site Description
Statutory Designated Sites		
Greater Wash SPA	Within the Scoping Boundary	The Greater Wash SPA lies along the east coast of England in the North Sea and extends between the counties of Yorkshire (to the north) and Suffolk (to the south). This area of the SPA includes a range of marine habitats including intertidal mudflats and sandflats, subtidal sandbanks, and biogenic reefs such as Sabellaria reefs and mussel beds. It is classified for the protection of red-throated diver (*Gavia stellata*), common scoter (*Melanitta nigra*) and little gull (*Hydrocoloeus minutus*) during the non-breeding season. For the breeding season it is classified for the protection of the sandwich tern (*Sterna sandvicensis*), common tern (*Sterna hirundo*) and little tern (*Sternula albifrons*). This area supports the largest breeding populations of little terns within the UK SPA network as it protects important foraging areas and supports the second largest aggregations of non-breeding red-throated diver and little gull.
Lambwath Meadows SSSI	4.9 km north of the Scoping Boundary	Lambwath Meadows SSSI is 29.6 ha and consists of a series of low-lying seasonally flooded hayfields. The meadows are one of the best examples of agriculturally unimproved species-rich, damp neutral alluvial grassland in north Humberside.
Holderness Inshore MCZ	Within the Scoping Boundary	Holderness Inshore MCZ is designated for intertidal sand, muddy sand, moderate energy circalittoral rock, high energy circalittoral rock, subtidal coarse sediment, subtidal mixed sediments, subtidal sand, subtidal mud and Spurn head (subtidal).
Non-Statutory Designated Sites		
Bail Wood Ancient Woodland	310 m west of the Scoping Boundary	Only boundary information held.
Humbleton LWS	1.2 km south-east of the Scoping Boundary	No information provided on citations, species lists or maps. Only boundary information held.

The site for the Proposed Development at the Aldbrough Gas Storage facility is predominantly hard standing, buildings, gas storage equipment and arable land. There is also some grassland, scrub, defunct hedgerows, and ditches. There are some standing water features, the majority which were dry when the Phase 1 habitat survey was undertaken in November 2022.

The construction works shall primarily take place across the existing storage facility, with minor works to take place across arable land, which have limited ecological value. However, some of the nearby habitats such as the woodland, ditches and grassland have the potential to support protected species.

12.3.3 Key Sensitivities

The key receptors for the Proposed Development are:

- European Protected Species and other protected species which could be vulnerable from impacts during the construction and operational stages.

- statutory designated sites and their qualifying interest features which could be vulnerable from impacts during the construction and operational stages; and
- isolated loss of hedgerow and grassland habitats, including temporary disturbance to ditches, which could be vulnerable from impacts during the construction stage.

12.4 Project Basis for Scoping Assessment

12.4.1 Construction

Whilst the construction of the Proposed Development will largely be on the existing operational site, some loss of terrestrial habitats is possible outside of the existing site boundary, some of which are possibly functionally linked to the Greater Wash SPA and/or Humber Estuary SPA SAC. This will be the focus of the HRA.

Construction without mitigation could also result in the direct disturbance of, and harm to, animals including the displacement of species from the proximity of the Proposed Development and within the boundary of the Greater Wash SPA. The assessment will determine the significance of these effects.

12.4.2 Operation

The operation of the Proposed Development could result in the disturbance and displacement of species which use site and/or are within the immediate surroundings as a result of light and noise pollution. This could also include effects within the Greater Wash SPA and any functionally linked land.

Other potential impacts include potential barriers on protected species moving through the area, noise or visual disturbance of birds in the surrounding land (including the Greater Wash SPA) and light disturbance on foraging and commuting bats within the Proposed Development.

12.5 Mitigation

Standard construction and operational good practice will be adopted to safeguard habitats and species, including buffers from watercourses, woodlands, and buffers for root protection zones. Good practices mitigation measures will be described in the ES and the means for securing them will be set out in a COCP.

Good practice measures aside, site-specific mitigation measures will also be identified following the completion of the surveys, EcIA and HRA.

12.6 Likely Significant Effects to be considered in the EIA

Ecological surveys are currently ongoing (started May 2022) at the Proposed Development Site and the completion of surveys is not anticipated until March 2023. Taking into consideration the surveys and assessments undertaken to date, the following points are relevant.

- Designated sites: there are multiple international designated sites within 5km of the Proposed Development. The Ecolgocial Impact Assessment (EcIA) and HRA processes will identify any likely significant effects on the national site network.
- Bats: The Proposed Development area provides low suitability for foraging and commuting bats, and there is no habitat suitable for roosting bats.
- Badgers (*Meles meles*): no evidence of badgers was identified during the surveys at the Proposed Development site; however, it is accepted that this is a mobile species and potential effects will be considered and mitigation including at the construction and decommissioning phase for the project.
- Birds: the habitats within the project site have good value to support breeding, roosting and foraging birds. Breeding bird surveys have identified a diverse breeding bird community of mainly

common species within the Proposed Development Area. These do include protected and sensitive species such as barn owl. Wintering bird and passage surveys have yet to be completed and habitats could support qualifying interest species of the Greater Wash SPA. These surveys are required to inform the assessment.

- Great Crested Newts (*Triturus cristatus*) (GCN): A total of 10 waterbodies are present within 500 m of the Proposed Development site, five of which are ditches/drains and five are ponds. Seven of these waterbodies could be accessed during the Extended Phase 1 habitat survey, of which four were assessed to be unsuitable for GCN. Further surveys of the waterbodies which could not be accessed and those suitable for GCN will be required to confirm the status of GCN in the area and to assess the impacts if their presence if confirmed.

12.7 Effects Scoped out of the EIA

While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

- Dormice: Scoped out of further assessment since the background data search indicated that dormice are considered absent from the county of East Riding of Yorkshire.
- Water Vole (*Arvicola amphibius*) and Otter (*Lutra lutra*): No signs of otter or water vole were identified during the extended Phase 1 Habitat survey. Ditches adjacent and within the site are considered unsuitable to support otter due to their shallow depths, areas of fragmentation and are unlikely to contain fish. The ditches on site were unsuitable to support water vole due to their small/shallow nature and because they were dry, overgrown, and heavily shaded. No evidence of water vole was recording during the survey.
- White-clawed Crayfish (*Austropotamobius pallipes*); Ditches at the Proposed Development site are not suitable for white-clawed crayfish.
- Reptile: Surveys undertaken in September 2022 did not identify reptiles using the Proposed Development site.

12.8 Proposed Approach to the Assessment

12.8.1 Baseline Habitat Survey of the Proposed Development Site

A Phase 1 Habitat survey was undertaken by ERM in November 2022. The Proposed Development Site was assessed for its suitability for protected and notable species and habitats were mapped based on the methods described in the Handbook for Phase 1 Habitat Survey (Join Nature Conservation Committee (JNCC), 2010). The survey classified the habitat types and provided a habitat description for each including dominant and notable plant species (**Figure 12.1**).

12.8.2 Species Surveys of the Proposed Development Site

A number of specific surveys for protected species have been undertaken in 2022, and further surveys are planned for 2023.

Badgers

During the Phase 1 Habitat Surveys, a walkover survey for badgers was also undertaken. Areas within the scoping boundary are of suitable sett building habitat however, no active setts or evidence of badgers were identified during the survey.

Bats

Any trees present are not of a sufficient age to have formed suitable roosting features such as cracks and flaking bark which are typical features for trees that support roosting bats. The areas of habitat

within the Proposed Development site offer negligible suitability for foraging and commuting bats, however, the woodlands and hedgerows adjacent are of low suitability for foraging and commuting bats. A series of transect surveys and static detector monitoring surveys commenced in May 2022 and were completed in September 2022. These surveys were undertaken as per the Bat Conservation Trust (BCT) guidance. No evidence of roosting bats was identified in any of the buildings within the substation, all these buildings were found to have negligible potential to support roosting bats.

Birds

Scattered trees and grassland within the proposed development area provide suitable habitat for breeding birds. The arable fields and beach also provide suitable overwintering habitat for birds. The Proposed Development is close to the Greater Wash SPA which is designated for its bird assemblages.

A series of surveys between March and November 2022 were undertaken. Survey data indicates a reasonably diverse breeding bird community of mainly still common species. Farmland birds in particular are well represented, with a high number of reed bunting, skylark and meadow pipit.

With the exception of nesting sand martins at low density in the clifftops; the beach and offshore area were largely lacking any bird interest. The narrow beach profile and high energy shore produces little suitable feeding or roosting habitat. No Great Wash SPA qualifying species were observed.

Wintering bird surveys are underway at the Proposed Development Site and surrounding area including the coastline from October 2022 to March 2023.

Great Crested Newts

There are 10 waterbodies within 500m of the Proposed Development. Of these waterbodies, four were assessed to be suitable for GCN, three unsuitable and three could not be accessed. There are no GCN records within 1 km of the Proposed Development.

Due to limitations on access not all the waterbodies within 500 m could be assessed for GCN, once access is permitted, these waterbodies will be assessed for their suitability for GCN. eDNA surveys will be undertaken to confirm presence or absence of newts on ponds which are deemed suitable for GCN.

Reptiles

Areas of grassland, scrub, woodland edges, and bare ground within the Proposed Development area provide suitable habitat for reptiles. There are records of grass snake (*Natrix natrix*) within 1 km of the Hydrogen Storage Facility.

Detailed reptile surveys were undertaken on the areas of suitable habitat (southeast of the site) in September 2022. No reptiles were found during these surveys.

12.8.3 Specific Methodologies

Survey methodologies will be undertaken as per the specific species guidelines as listed below:

- Chanin P (2003). Monitoring the Otter (*Lutra lutra*). Conserving Natura 2000 Rivers Monitoring Series No,10, English Nature, Peterborough.
- Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust. London.
- Dean, M., Strachan, R., Gow,D. and Andrews, R. (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Matthews and Paul Chanin. The Mammal Society, London.

- Gilbert, G., Gibbons, DW and Evans, J (1998) Bird Monitoring Methods: A Manual of Techniques for Key UK Species.
- Harris, S., Cresswell, P., and Jefferies, D. (1989). Surveying Badgers. Occasional publication No.9 Mammals Society, London.
- Institute of Environmental Assessment (1995) Guidelines for Baseline Ecological Assessment, Spon, London.
- Joint Nature Conservation Committee. (2010). Handbook for Phase 1 Habitat Survey - a Technique for Environmental Audit (revised reprint). Joint Nature Conservation Committee, Peterborough.
- Marchant, J.H. (1983). Common Bird Census Instructions. BTO, Tring.
- Natural England. (2001). Great Crested Newt Mitigation Guidelines.
- Oldham R.S., Keeble J., Swan M.J.S. and Jeffcote M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal 10 (4), 143-155.
- Peay, S. (2002). Guidance on habitat for White-Clawed Crayfish. Environment Agency, Wallingford.
- Peay, S. (2003). Monitoring the White-Clawed Crayfish (*Austropotamobius pallipes*). Conserving Natura 2000 Rivers. Monitoring Series No.1. English Nature. Peterborough.
- Shawyer, C.R. (2011) Barn Owl *Tyto alba*: Survey Methodology and Techniques for use in Ecological Assessment. Developing Best Practice in Survey and Reporting. IEEM, Winchester; and
- Strachan, R., Moorhouse,T. and Gelling, M. (2011). Water Vole Conservation Handbook. Third Edition. Wildlife Conservation Research Unit, Oxford.

12.8.4 Assessment Criteria

Methodology

The approach taken for the assessment of ecological effects will follow the CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland. These guidelines set out the following process for assessment:

- evaluation of the importance of features identified during the desk study and baseline surveys, with those considered to be Important Ecological Features (IEFs) scoped into the assessment, and those considered to be of local importance or not present scoped out.
- identification and characterisation of potential effects on IEFs.
- assessment of potential effects on IEFs, both from the Development alone and cumulatively with other developments in the surrounding area.
- identification of measures required to mitigate (avoid, minimise, reduce) adverse effects and to introduce possible enhancements; and
- assessment of the significance of any residual effects after mitigation.

The Ecology and Nature Conservation section will contain the ecological assessment and be supported by technical appendices detailing the desk study results, consultation, survey methodologies and results (including figures, tables, photographs, and maps). Information relating to badger, a protected and sensitive species, will be presented in a confidential annex with restricted access. The section will include measures to mitigate likely adverse effects, either by sensitive design or applied techniques, and will outline measures to enhance biodiversity with the view of delivering net gain, as well as the requirement for associated monitoring and adaptive management.

Determining Value

The baseline conditions, including the importance of environmental features on or near to the Proposed Development, or the sensitivity of potentially affected IEFs, will be assessed in line with best practice guidance, legislation, statutory designations, and professional judgement.

Ecological and ornithological features can be important for a variety of reasons, and may relate, for example, to rarity, the extent to which they are threatened throughout their range, or to their rate of decline. The level of importance of features identified during the Desk Study and Baseline Surveys will be determined with reference to CIEEM guidance, and include a consideration of relevant legislation, conservation status, population size and distribution and the level of AHP Project site use with potential to impact habitats and protected species.

It is anticipated that features matching the criteria for Local, or higher, importance level will be included in the EIA. Features of Less than Local importance will be scoped out of the assessment; however, where relevant, safeguards necessary to ensure legal compliance (i.e., protection of nesting common bird species) will be included.

Criteria for Impact Magnitude

The following criteria will be considered when identifying potential effects of the Proposed Development on ecological features.

- Nature of effect: whether it is beneficial to features or detrimental.
- Extent: the spatial or geographical area over which the effect may occur.
- Magnitude: the size, amount, intensity, and volume of an impact that leads to the effect.
- Duration: the duration of an effect as defined in relation to ornithological characteristics (such as a species' life cycle) as well as human timeframes. It should also be noted that the duration of an activity may differ from the duration of the resulting effect, e.g., if short-term construction activities cause disturbance to breeding birds, there may be long-term implications from failure to reproduce that season.
- Frequency: the number of times an activity occurs may influence the resulting effect.
- Timing: this may result in an impact on an ecological feature if it coincides with critical life stages or seasons.
- The criteria for assessing the magnitude of an ecological impact that leads to an effect are as follows:
- Large: A change to the baseline condition of the IEF, leading to total loss or major alteration of the relevant population.
- Medium: A change to the baseline condition of the IEF, leading to partial loss or alteration of the relevant population.
- Small: A slight change to the baseline condition of the IEF; and
- Negligible: No identified change from baseline conditions.

Criteria for Impact Significance

CIEEM guidance discourages the use of the matrix approach to determining significance and describes only two categories: 'significant' and 'not significant'.

CIEEM guidance describes the approach to determining significance, including, for example:

- an effect "that either supports or undermines biodiversity conservation objectives for important ecological features or for biodiversity in general".

- effects which “encompass impacts on the structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution).”

The guidance also notes that “*significant effects should be qualified with reference to an appropriate geographic scale*” (e.g., local, national, and international).

13. LANDSCAPE AND VISUAL AMENITY

13.1 Introduction

This section sets out the proposed methodology and approach to be applied in the Landscape and Visual Impact Assessment (LVIA). It presents the suggested scope of the LVIA in terms of those landscape and visual effects to be scoped in and scoped out of the assessment process based on a preliminary assessment of relevant impacts on receptors from the Proposed Development.

The purpose of the LVIA is to identify and record the potential significant effects that the Proposed Development may have on physical elements of the landscape; landscape character; areas that have been designated for their scenic or landscape-related qualities; and views from various locations such as settlements, routes, hilltops and other sensitive locations. The potential cumulative effects that may arise from the addition of the Proposed Development to other large scale infrastructure developments are also considered.

The LVIA will consider the potential effects of the Proposed Development during the following development stages:

- construction of the Proposed Development.
- operation of the Proposed Development; and
- decommissioning of the Proposed Development.

13.2 Topic-specific Regulatory Requirements and Guidance

Paragraph 174, of the NPPF states that: "*planning policies and decisions should contribute to and enhance the natural and local environment*" by, amongst other things, "*protecting and enhancing valued landscapes […] (in a manner commensurate with their statutory status or identified quality in the development plan)".*

The methodology for the LVIA is based on current best practice guidance, namely:

- Landscape Institute/ Institute of Environmental Management and Assessment (2013), 'Guidelines for Landscape and Visual Impact Assessment', 3rd Edition ('GLVIA3')[84];
- Landscape Institute (2013), GLVIA3 Statement of Clarification 1/13[85];
- Landscape Institute (2019), 'Visual Representation of Development Proposals', Technical Guidance Note[86];
- Landscape Institute (2021), Technical Guidance Note 02/21 Assessing landscape value outside national designations[87];
- Natural England and DEFRA (2014) Landscape and Seascape Character Assessments[88].
- Natural England (2014) An Approach to Landscape Character Assessment[89]

[84] Landscape Institute and Institute of Environmental Management and Assessment (2013) *Guidelines for Landscape and Visual Impact Assessment*, 3rd Edition, Routledge, London.
[85] The Landscape Institute (2015) *GLVIA3 – Statements of Clarification*. Available online at: https://www.landscapeinstitute.org/technical-resource/glvia3-clarifications/
[86] The Landscape Institute (2019) *Visual Representation of Development Proposals, Technical Guidance Note 06/19*. Available online at: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2019/09/LI_TGN-06-19_Visual_Representation.pdf
[87] Landscape Institute (2021) *Technical Guidance Note 02/21: Assessing landscape value outside national designations*. Available online at https://www.landscapeinstitute.org/publication/tgn-02-21-assessing-landscape-value-outside-national-designations/
[88] Natural England and DEFRA (2014) *Landscape and Seascape Character Assessments*. Available online: https://www.gov.uk/guidance/landscape-and-seascape-character-assessments
[89] Natural England (2014) *An Approach to Landscape Character Assessment*. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/691184/landscape-character-assessment.pdf

13.3 Baseline Environment

13.3.1 Description

Proposed Development

The Proposed Development lies entirely within an earth bund that is well vegetated, created as part of Aldbrough Phase 1 to visually screen the facility, in an otherwise grassland landscape that comprises a low-lying, undulating plain with the broad, shallow drains, enclosed by flood banks which drain into the North Sea. There are associated river systems with their many drains, dykes and streams and these enhance the biodiversity and historic environment of the landscape.

The Proposed Development lies within a rural – urban fringe area with occasional manmade / industrial features, including Aldbrough Phase 1, which are large scale features within the landscape. The topography of the Proposed Development is low-lying flat land at approximately 15 m AOD.

Withernwick Wind Farm, which comprises nine wind turbines, is situated 4 km north-west of the Proposed Development. In addition, four wind turbines lie immediately north of Cowden Lane, forming Withernwick Extension. The surrounding area includes the Bailwood Scout Campsite and the B1242 Aldbrough Road which provides access to the site. The Cess Dale Drain and East Newton Drain flow around the periphery of the Proposed Development.

Landscape Character

The Proposed Development falls within the National Character Area (NCA) Profile 40 (NE437): Holderness which is broadly characterised as a generally low-lying landscape, underlain by glacial boulder clay.

At a local level, the East Riding of Yorkshire Landscape Character Assessment Update (2018)[90] divides the landscape of the county into 23 Landscape Character Types (LCTs). These have been refined further into 81 Landscape Character Areas (LCAs). The Proposed Development is predominantly situated within LCT 20: Coastal Farmland and LCA 20B: Hornsea to Withernsea Coast.

This LCA is described as covering the coastal landscape between the southern edge of Hornsea and the northern edge of Withernsea. Designated with conservation areas, the settlements of Mappleton, Aldbrough, Hilston and Tunstall lie within the boundary of the LCA itself. Land use is largely arable farmland, characterised by large rectilinear field patterns with smaller fields associated with the edges of villages, hamlets, or farmsteads. Tree coverage is generally limited to plantation woodland. Caravan sites form a prominent feature of the LCA. Evidence of human influence is also provided by a linear golf course to the south of Hornsea as well as small scale wind farm development.

The sensitivity of LCA 20B: Hornsea to Withernsea Coast to industrial development is defined as ‘medium-high’ within the published East Riding of Yorkshire Landscape Character Assessment Update.

The western extent of the Proposed Development lies within the boundary of LCT 19: Open Farmland, further subdivided into LCA 19D: Central Holderness Open Farmland. Consistent with neighbouring LCAs to the east, this LCA consists of open agricultural land. The land use is typically arranged in large fields bordered by hedgerows / tracks with limited woodland coverage. The landscape is also described as large scale with a gently undulating topography, resulting in the availability of panoramic views.

[90] East Riding of Yorkshire Landscape Character Assessment (2018) *Planning Permission and Building Control*. Available at: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/landscape-character-assessment/

The published East Riding of Yorkshire Landscape Character Assessment Update describes the sensitivity of LCA 19D: Central Holderness Open Farmland to industrial development as 'high-medium'.

The boundaries of the LCAs defined within the published East Riding of Yorkshire Landscape Character Assessment Update will be used as the landscape reporting units for the LVIA.

Landscape Designations

There are no statutory landscape designations (National Parks or Areas of Outstanding Natural Beauty (AONB)) within the Proposed Development or within 20 km of the Proposed Development. The nearest is the Lincolnshire Wolds AONB, approximately 30 km south of the Proposed Development.

The adopted East Riding Local Plan (2016) identifies 'Important Landscape Areas', locally designated non-statutory designations within Policy ENV2: Promoting a High-Quality Landscape. However, the Site is not included within this local designation, located approximately 23.6 km east (at its nearest extent) from land lying within the Yorkshire Wolds.

Visual Receptors and Visual Amenity

Visual effects will be experienced by the people who live and work in the area, together with those enjoying recreational activities in this area or simply passing through. Visual receptors are the people who would be affected by changes in views, and they are usually grouped by their activities at those places. This includes residents within settlements, users of the local transport network and PRoW as well as people visiting local areas of interest.

Residential Receptors

The pattern of settlement within the vicinity of the Proposed Development is characterised by small villages / hamlets and dispersed individual farmsteads linked by a network of minor roads. Larger villages, including Aldbrough, tend to be nucleated in form. Views towards the Proposed Development would be potentially available from these locations.

Recreational Receptors

Users of the local PRoW network form potential visual receptors. Views would be potentially available from a bridleway (Aldbrough Bridleway No. 16 / East Garton Bridleway No. 4) connecting land immediately south of the site boundary with the route of an unnamed road at Garton. Furthermore, a network of PRoW radiate from Aldbrough, connecting the village with the wider landscape. Aldbrough Footpath No. 14 lies to the south of the village, forming a wider connection with Aldbrough Footpath No. 1 which runs to the west of Bail Wood. Potential visibility would also be potentially afforded from recreational users of Aldbrough Sands and the wider beach frontage.

Transport Routes

There is a network of local, rural roads within the vicinity of the Proposed Development, including the B1242 and the B1238. The LVIA will consider the effects on sequential views experienced by road users, including the pattern of visibility and how this would affect views from the road network.

13.3.2 Study Area

Based on the anticipated visibility of the Proposed Development and initial identified landscape and visual receptors, the assessment will utilise a study area of 2.5km radius around the site boundary for the examination of effects on landscape character and views / visual amenity.

It is judged that likely significant landscape and visual effects would not occur beyond these distances. A Zone of Theoretical Visibility (ZTV) will be generated to show the maximum visibility of

the Proposed Development based on upper height limits (up to 25m) as established in parameter plan.

13.3.1 Representative viewpoints

An assessment of the visual effects of the Proposed Development will be based on the analysis of the ZTV, field studies and assessment of representative viewpoints. Viewpoint selection has followed good practice guidance and in particular paragraphs 6.18 to 6.20 within GLVIA3.

A list of proposed viewpoints for the assessment is set out in Table 13.1 below. The list has been compiled to provide a representative range of viewing distances and viewing experiences. Final viewpoint positioning will be informed by consultation responses and refinement in the field.

Table 13-1 Representative Viewpoints

Viewpoint number	Viewpoint location	X	Y	Approximate distance from the Site
VP1	View looking west from Aldbrough Bridleway No. 16	526998	436835	0.4 km
VP2	View looking northeast from East Garton Footpath No. 2	525109	435997	1.0 km
VP3	View looking southwest from Aldbrough Sands	526798	438083	1.1 km
VP4	View looking southeast from Willow Grove, Aldbrough	524324	438370	2.0 km
VP5	View looking north from the B1242 Aldbrough Road	526357	435548	1.3 km

Baseline photographic panoramas will be produced during winter to represents the worst-case scenario for each viewpoint, illustrating the nature of existing views in the direction of the Proposed Development.

13.3.2 Data Sources used in Scoping

A number of different sources of information have been reviewed in scoping and will be examined in more detail during the LVIA to help understand the Proposed Development and its surrounding context as follows:

- Natural England (September 2014) National Character Area Profiles[91];
- East Riding of Yorkshire Landscape Character Assessment Update.
- East Riding of Yorkshire Local Plan (April 2016)[92];
- OS mapping at 1:50,000, 1:25,000 and 1:10,000;
- aerial photography; and
- Google Earth, Street View and Maps.

13.3.3 Key Sensitivities

At this stage, the key sensitivities are considered to be:

[91] Natural England (2014) *National Character Area Profiles.* Available at: https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles

[92] East Riding of Yorkshire Council (2016) *Local Plan*. Available at: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/

- potential direct and indirect landscape effects on effects on local landscape character, including cumulative effects, particularly on the host landscape character types.
- views from key visual receptors including from key routes, settlements and nearby individual properties.
- cumulative effects on users of the main and local road network.

13.4 Project Basis for Scoping Assessment

The following aspects of the Proposed Development are likely to bring about landscape and visual effects on the landscape and visual receptors:

- construction of surface infrastructure of the Proposed Development.
- operation of Proposed Development and presence of above ground infrastructure; and
- decommissioning of the Proposed Development.

13.5 Mitigation

The Proposed Development will include measures to mitigate landscape and visual impacts that will be developed as the design proceeds. The landscape and visual objectives of the mitigation will be to:

- screen elements of the Proposed Development from key visual receptors, e.g., nearby residential properties, PRoW, etc;
- soften the edges of the Proposed Development and help integrate it with its wider landscape setting; and
- reflect existing landscape elements, such as the existing well vegetated earth bund with associated tree planting, and characteristics of the wider landscape.

The mitigation will also seek to make the most of opportunities to improve biodiversity within the Proposed Development and surrounding area by:

- minimising impacts on existing habitats and species during the construction phase.
- extending and / or enhancing the few most valuable existing habitats on the Proposed Development; and
- creating new habitats on the Proposed Development that reflect the natural flora and fauna of the area.

It is assumed that typical mitigation and enhancement measures will be incorporated within the design of the Proposed Development as ‘primary’ mitigation to avoid any ‘significant’ or unacceptable adverse landscape and visual effects, or which reduces them to acceptable levels. These are likely to include the following:

- retaining any existing hedgerows and trees within and to the perimeter of the Proposed Development (where possible) and incorporating them within the design to maintain landscape character as well as to filter and screen views of the Proposed Development.
- reinforcement of any gaps in existing hedgerows with the planting of locally indigenous hedgerow species;
- planting new hedgerows, e.g., as a double staggered row using locally indigenous hedgerow species supplied as forestry transplants (40/60 cm high);
- incorporating hedgerow trees to new and existing hedgerows to help reinstate characteristic landscape elements / features, using locally indigenous species supplied as selected standards (minimum 300 cm high); and

- improving the management of existing vegetation, watercourses, and any ponds at the Proposed Development.

Overall, mitigation measures incorporated with the Proposed Development would aim to achieve biodiversity net gain (BNG).

13.6 Likely Significant Effects to be considered in the EIA

Table 13-2 below is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, where appropriate noting actions, including baseline data acquisition, for significant effects scoped in. The basis for scoping out certain effects is presented after the table.

As decommissioning shall be approximately 25 years post start of operation, it will not be addressed to the same level of detail as the other phases and in general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

Table 13-2 Likely Effects - LVIA

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction of surface infrastructure for the Proposed Development	Existing bund / screening measures	Overall, the effects of construction on landscape resources will be restricted to small geographical areas within the Proposed Development and are unlikely to result in the removal of any important or unusual landscape features. The effects would be of short duration, temporary in nature (approximately 36 months) and localised resulting in no meaningful influence on the local landscape character beyond the Proposed Development itself.	Scoped In. The visual effects of the Proposed Development during the construction period would be most noticeable from 'close-range views' of the construction activity, including the creation of layout areas, temporary compound and construction vehicles using the access road and entrance. Initially the primary visual effects during the construction period would be seen in the increase in vehicular movements	Construction phase programme and proposed design.
Operation of Proposed Development	The landscape and visual objectives of the embedded mitigation are: to screen elements of the Proposed Development from key receptor locations, e.g. nearby residential properties; to soften 'hard edges' of the Proposed	Compared to the construction phase, the Proposed Development would gain a more 'settled' appearance during the operational period when construction activity ceases. The Proposed Development would have permanent effects on the landscape and would be visible over a limited area with potential for indirect effects on the surrounding landscape and surrounding visual receptors.	Scoped In.	Proposed design Maximum development parameters

	Development from the PRoW; and to reflect existing landscape elements – such as the bund, and character in areas of the wider landscape setting.	Flaring of Hydrogen is may be used for safe shutdown, emergency and maintenance purposes. This flaring will arise from vent point(s) sited within the footprint of the Proposed Development. Given the rural nature of the receiving environment the intermittent use of flaring would be visible over a limited area with potential for indirect effects on the surrounding landscape and surrounding visual receptors.		
Decommissioning of the Proposed Development	No specific mitigation measures proposed	Overall, the effects of decommissioning phase on landscape resources will be restricted to small geographical areas within the Proposed Development. The effects would be of short duration (approximately 36 months) and localised and would not have any meaningful influence on the local landscape character beyond the Proposed Development itself.	Scoped In. Potential landscape and visual effects at this stage would include, but would not be restricted to, temporary vehicular routes for vehicles, a temporary deconstruction compound, car park and laydown areas for the decommissioning of the Proposed Development which could result in landscape and visual effects during the decommissioning period.	Decommissioning phase programme

13.7 Effects Scoped out of the EIA

While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

The following landscape and visual receptors have been scoped out of the LVIA:

- LCTs/LCAs located beyond 2.5km of the Proposed Development:
- LCTs/LCAs within 2.5 km of the Proposed Development, but which do not fall within the ZTV output: and
- Visual effects on visual receptors beyond the 2.5km Visual Study Area or those locations judged to have limited or no visibility of the Proposed Development following the results of the ZTV and verification on site.

A preliminary assessment will accompany the LVIA to ascertain which visual receptors are assessed in detail.

13.8 Proposed Approach to the Assessment

13.8.1 Specific Methodologies

The two components of LVIA are based on the following definitions:

- 'Assessment of landscape effects: assessing effects on the landscape as a resource in its own right'; and
- 'Assessment of visual effects: assessing effects on specific views and on the general visual amenity experienced by people.'

The Proposed Development may have a direct (physical) effect on the landscape in which it is located, as well as a perceived effect from landscape character areas surrounding it. The potential landscape effects, occurring during the installation and operation of the Proposed Development may therefore include, but are not restricted to, the following.

- *Changes to landscape elements*: the addition / revision of new elements and other characteristic elements of the landscape character type.
- *Changes to landscape qualities*: degradation, erosion, or reinforcement of landscape elements and patterns, and perceptual characteristics, particularly those that form key characteristic elements of landscape character types.
- *Changes to landscape character*: landscape character may be affected through the effect on characteristic elements (including perceptual characteristics), landscape patterns and attributes and the cumulative addition of new features, the magnitude and presence of which is sufficient to alter a notable part of the overall landscape character type of a particular area.
- *Cumulative landscape effects*: where more than one development may lead to a potential landscape effect.

Visual effects are concerned wholly with the effect of development on visual receptors and general visual amenity. Visual effects are identified for different receptors (people) who would experience the view such as at their places of residence, during recreational activities, at work, or when travelling through the area. Visual effects may include the following:

- *Visual effect*: change in the appearance of the landscape as a result of development. This may include changes to the quality of the view, ability of the visual receptor to appreciate the view, or changes to the characteristic elements within the view. These changes can be positive (i.e. beneficial or an improvement) or negative (i.e. adverse or a detraction).
- *Cumulative visual effects*: the cumulative or incremental visibility of similar types of development may combine to have a cumulative visual effect.

Particular attention will be dedicated to the Proposed Development's effect on local residents as they would experience effects from different locations, at different times of the day, usually for longer periods of time, and in different seasons.

The visual assessment will draw from the ZTV, site visits and viewpoint analysis and assesses the potential visual effects on views and visual amenity likely to be experienced by receptors (people) within the landscape as follows:

- Views from residential properties and settlements; Particular attention is dedicated to the Proposed Development's impact on local residents because they would experience the Proposed Development from different locations, at different times of the day, usually for longer periods of time, and in different seasons;
- Views from valued landscapes.
- Views experienced while travelling through the landscape (recreational road users, walkers, horse riders, cyclists for example); and

- Views from tourist and recreational destinations.

13.8.2 Visualisations

Annotated baseline photographs to reflect the maximum likely parameters of the Proposed Development, including its potential extent and location in each view, would be produced to support the LVIA. These annotated views will be used to assess potential visual effects as well as identify gaps in the existing landscape planting that will need to be addressed through additional mitigation works.

13.8.3 Cumulative Assessment

In addition to assessing the Proposed Development as a standalone scheme, the LVIA will also consider the potential additional effects on landscape character and visual amenity of the Proposed Development in conjunction with other planned infrastructure development in the vicinity.

An assessment of the cumulative effects with existing infrastructure development will be undertaken in line with GLVIA3, and according to the following definitions.

- Cumulative effects are defined as the additional changes caused by the Development in conjunction with other similar developments or as the combined effect of a set of developments, taken together (NatureScot, 2012:4).
- Cumulative seascape effects are defined as effects that 'can impact on either the physical fabric or character of the landscape or any special values attached to it' (NatureScot, 2012:10).
- Cumulative visual effects are defined as effects that can be caused by combined visibility, which 'occurs where the observer is able to see two or more developments from one viewpoint' and/or sequential effects which 'occur when the observer has to move to another viewpoint to see different developments' (NatureScot, 2012:11).

13.8.4 Assessment Criteria

Essentially, the level of landscape and visual effect (and whether this is significant) is determined through consideration of:

- the 'sensitivity' of landscape and visual receptors will combine professional judgements on susceptibility and value, using the principles set out in GLVIA3; and
- the 'magnitude of change' posed by the Proposed Development will take into account a combination of judgements including size / scale, geographical extent, duration and reversibility (as defined within GLVIA3).

The process involves design and re-assessment of any remaining, residual significant adverse effects that could not otherwise be mitigated or 'designed out'. Landscape or visual sensitivity is ranked from high, medium, low to negligible and the magnitude of change is similarly ranked from large, medium, small to negligible as indicated in **Table 13-3**. The type of effect is also considered and may be direct or indirect, temporary, or permanent, cumulative, and positive, neutral, or negative. The landscape and visual assessment involve a combination of both quantitative and subjective assessment and wherever possible will seek to gain a consensus of professional opinion through consultation, peer review and the adoption of a systematic, impartial, and professional approach.

In accordance with EIA Regulations, it is essential to determine whether the predicted effects are likely to be 'significant'. Significant landscape and visual effects, in the assessor's opinion, resulting from the Proposed Development would be all those effects that normally result in a 'major', a 'moderate – major', or 'moderate' effect with any exceptions being clearly explained (refer to **Table 13-3** below).

Effects predicted to be of major, moderate to major or moderate significance are considered to be 'significant' in the context of the EIA Regulations and are shaded in light grey in **Table 13-3**.

Table 13-3 Evaluation of Landscape and Visual Effects

		Sensitivity (value / importance)			
		High	**Medium**	**Low**	**Negligible**
Magnitude of change	**Large**	Major	Moderate – Major	Minor – Moderate	Not significant
	Medium	Moderate – Major	Moderate	Minor	Not significant
	Small	Minor – Moderate	Minor	Not significant to Minor	Not significant
	Negligible	Not significant	Not significant	Not significant	Not significant

14. HISTORIC ENVIRONMENT

14.1 Introduction

This section outlines the scope of the historic environment assessment for the terrestrial elements of the Proposed Development. It provides a summary of legislation and guidance, a brief methodology and an overview of baseline conditions including previous archaeological work carried out within the Scoping Boundary and in the immediate vicinity.

14.2 Topic-specific Regulatory Requirements and Guidance

The national policy and legislation specifically relating to archaeology and cultural heritage used to undertake this scoping assessment is as follows:

- Ancient Monuments and Archaeological Areas Act 1979 (amended by the National Heritage Act 1983 and 2003)[93];
- NPPF (Section 16 - Conserving and enhancing the historic environment) (2012, revised 2021)[94];
- Planning (Listed Buildings and Conservation Areas) Act 1990 (amended by the Enterprise and Regulatory Reform Act 2013)[95]; and
- Planning Practice Guidance (PPG)[96] – Historic Environment provide up to date policy with regard to the assessment of harm to heritage assets.

The industry specific best practice and guidance specifically relating to archaeology and cultural heritage used to undertake this scoping assessment is as follows:

- Chartered Institute for Archaeologists (CIfA) guidelines: Standard and guidance for archaeological desk-based assessment (2020)[97];
- CIfA (2020) Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment[98];
- English Heritage (2008) Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment[99];
- Hedgerow Regulations 2019 (As Amended)[100];

[93] The National Archives, UK Legislation (1979) *Ancient Monuments and Archaeological Areas Act.* Available online: https://www.legislation.gov.uk/ukpga/1979/46

[94] Ministry of Housing, Communities and Local Government (2012) *National Planning Policy Framework.* Available online: *https://www.gov.uk/government/publications/national-planning-policy-framework--2*

[95] The National Archives, UK Legislation (1990) *Planning (Listed Buildings and Conservation Areas) Act.* Available online: https://www.legislation.gov.uk/ukpga/1990/9/contents

[96] Government of UK (2016) *Planning practice guidance*. Available online: https://www.gov.uk/government/collections/planning-practice-guidance

[97] Chartered Institute for Archaeologists (CIfA) (2020) *Standard and guidance for historic environment desk-based assessment.* Available online at: https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_4.pdf

[98] Chartered Institute for Archaeologists (CIfA) (2020) *Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment*. Available online: https://www.archaeologists.net/sites/default/files/CIfAS%26GCommissioning_2.pdf

[99] Historic England (2008) *Conservation Principles, Policies and Guidance*. Available online: https://historicengland.org.uk/images-books/publications/conservation-principles-sustainable-management-historic-environment/

[100] The National Archives, UK Legislation (1997) *The Hedgerows Regulations*. Available online: https://www.gov.uk/guidance/countryside-hedgerows-regulation-and-management

- Historic England (2015) Historic Environment Good Practice Advice in Planning Note 2: Managing Significance in Decision-Taking in the Historic Environment[101];
- Historic England (revised 2017) Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets[102]; and
- Historic England (2016) Preserving Archaeological Remains, Decision-taking for Sites under Development[103].

14.3 Baseline Environment

14.3.1 Data Sources used in Scoping

The data sources utilised for this assessment include:

- Historic England (National Heritage List) for information on World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, and Historic Battlefields[104];
- The Humber Archaeology Partnership Historic Environment Record (HER)[105];
- readily accessible published sources and grey literature (e.g., results from previous studies);
- historical Ordnance Survey mapping; and
- relevant published and grey literature historic environment reports.

14.3.2 Description

Proposed Development

Low density hunter-gatherer occupation of this part of the Holderness coastline is known from the Palaeolithic onwards, evidenced today by flint finds in agricultural land, though in other parts of East Yorkshire, more concentrated Mesolithic settlement has been identified on the edge of resource-rich wetlands and meres[106]. It is important to note, however, that although the evidence for hunter-gatherer settlement within the study area is not currently well attested, the limited amount of targeted research means that the paucity of known sites could be a reflection of the lack of survey and excavation, rather than an accurate representation of past human occupation or the potential for remains of these periods to survive.

Though well established for the broader East Riding area, until relatively recently, little was known about the later prehistoric occupation of central and coastal Holderness, with much of the evidence for Neolithic and Bronze Age settlement coming from flint findspots and scatters in ploughed fields. It has been generally thought that this part of Yorkshire remained sparsely populated compared to other

[101] Historic England (2015) *Historic Environment Good Practice Advice in Planning: 2, Managing Significance in Decision-Taking in the Historic Environment*. Available online: https://historicengland.org.uk/images-books/publications/gpa2-managing-significance-in-decision-taking/

[102] Historic England (2017) *Historic Environment Good Practice Advice in Planning Note 3 (Second Edition), The Setting of Heritage Assets*. Available online: https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/heag180-gpa3-setting-heritage-assets/

[103] Historic England (2016) *Preserving Archaeological Remains*. Available online: https://historicengland.org.uk/images-books/publications/preserving-archaeological-remains/

[104] Historic England (2022) *The National Heritage List for England (NHLE)*. Available online: https://historicengland.org.uk/listing/the-list/

[105] Hull City Council (2022) *The Humber Historic Environment Record (HER)*. Available online at: https://www.hull.gov.uk/environment/environment/humber-historic-environment-record

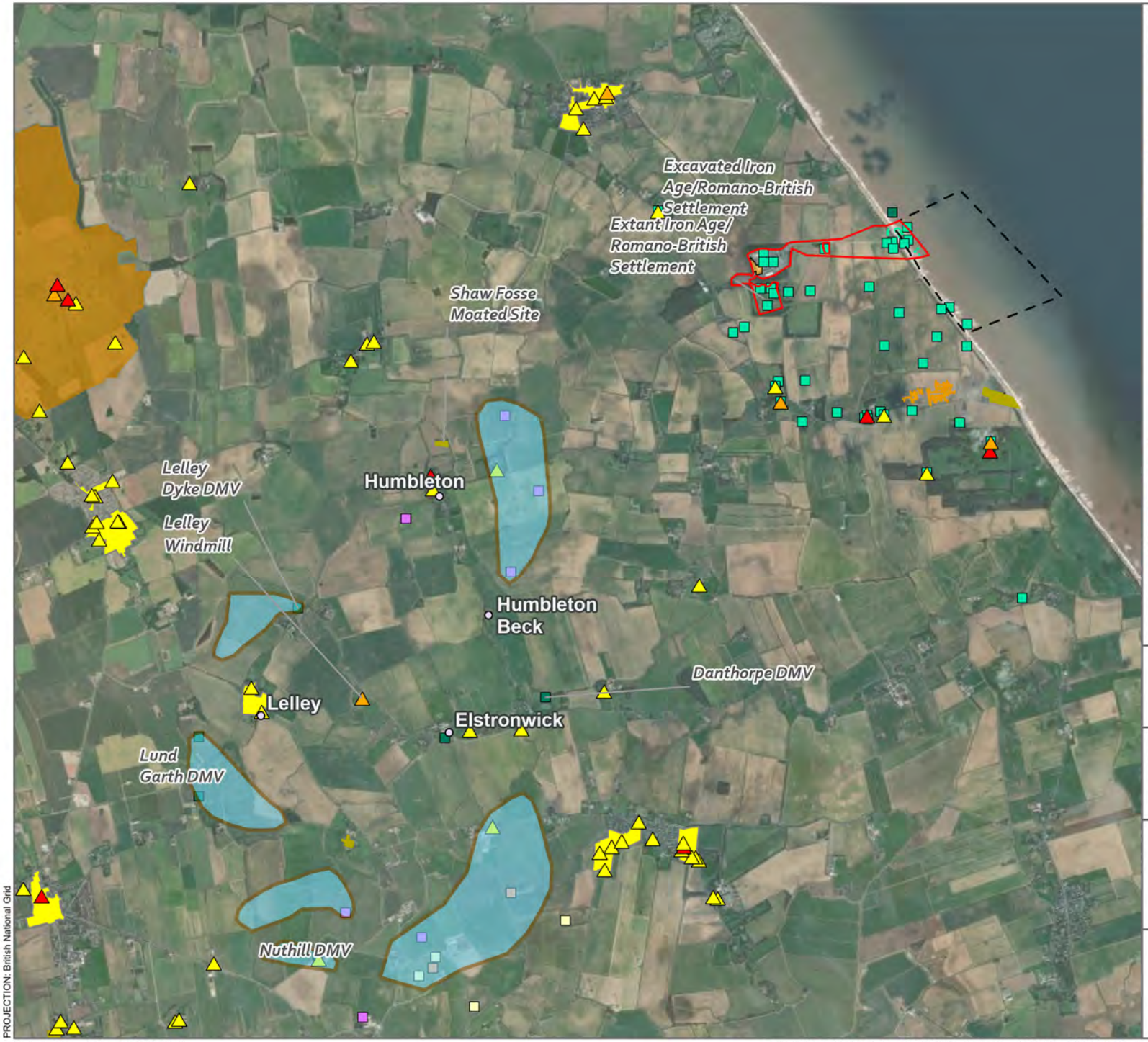
[106] The earliest evidence of human occupation in East Yorkshire comes from Gransmoor in Holderness, where an antler harpoon was discovered lodged in a birch log dated to 9,500 BC. A Palaeolithic hand axe was found in Yorkshire near Redcar in 2008, and additional Palaeolithic finds have been found surrounding Hull, at Bridlington, Doncaster, and Keyingham. The most heavily concentrated Mesolithic sites in Yorkshire are notably at Star Carr in the Vale of Pickering, throughout the high Pennines, e.g., on the moors around Marsden, on Oxenhope Moor, and Conistone, Kilnsey, and Malham Moors in the Dales, and Upper Haw at the head of Nidderdale.

regions. A number of likely Bronze Age barrows are, however, known from the area, the nearest concentration of which is located approximately 4 km to the south-west of the Proposed Development Scoping Boundary. Slightly further afield, bronze and timber finds from this period are known from wetland locations and the Humber Estuary silts have been shown to preserve organic remains from the Bronze Age including some recent spectacular finds of boats and enclosures. As with the earlier periods of prehistory, it cannot be assumed, however, that buried Neolithic and Bronze Age settlement remains are not present within the Scoping Boundary.

Similarly, the Iron Age occupation of the wider East Riding region has been well known for decades however little had been known about the central Holderness coast itself. Recent development-led archaeology over the last two decades, including within and adjacent to the Aldbrough Gas Storage site (Figure 14.1) has radically altered our perception of the Iron Age and Romano-British settlement of this area. It is now clear that this was a relatively well populated farmstead landscape with small settlements connected with field-systems and trackways throughout. A system of coastal signal stations is also known to have been developed during the latter part of the Roman occupation, and it is supposed that at least three such stations were located between Flamborough Head and Spurn Point. Whilst some of these may have been lost to the sea, a cropmark identified just outside the current Scoping Boundary has been interpreted as possible remains of one of these sites.

Anglo-Saxon and early medieval rural settlement patterns are also traceable in place name evidence, extant field boundaries and deserted and shrunken villages, all of which can be found within, or adjacent to, the Scoping Boundary. This includes the deserted medieval village (DMV), known as Grimston, located to the south of the current Scoping Boundary, in the location named ‘Old Garths’ on modern OS maps and extending west towards St Michael’s Church (**Figure 14.1**).

The post-medieval village and field landscape is still largely intact, and the characteristic ridge and furrow can still be seen in places across the region. The area is also well known for its coastal defences and observation posts, which as noted above were first established in the Roman period. Beacon Hill located to the east of the Scoping Boundary was used for this purpose from at least the beginning of the 19th century and possibly earlier (**Figure 14.1**). The area is best known, however, for its network of WWII defences, including Ringbrough Battery located inside the north-east edge of the Scoping Boundary, where the remains of a World War II Heavy Anti-Aircraft (HAA) gun installation can be found. Associated extant features include a pillbox (which predates the battery), a camp, a bunker complex and at least one surviving observation post (on the site of earlier military look out points on Beacon Hill) and former minefields. Only part of the military installation remains on the cliff top today however many of its components still survive on the beach below **Figure 14.1**.



Designated Assets

Listed Building

- I
- II*
- II

Conservation Areas

Parks and Gardens

Scheduled Monument

Non Designated Assets

- Deserted Medieval Villages and Settlments
- Barrows
- Possible Romano-British Site (Crop Mark)
- Possible Round Barrow
- Possible Square Barrow
- Non Designated Point

Deserted Medieval Villages - Grimston

Non Designated Linear

Non Designated Area

Area of high archaeological potential

Site Boundary

- Onshore
- Offshore

0 500 1,000 1,500 2,000

Metres

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: DN
PROJECT: 0653313	CHECKED: SE
DATE: 03/03/2023	APPROVED: RB

Figure 14.1
Cultural Heritage Context

ERM

PROJECTION: British National Grid

Earthstar Geographics, Natural England

Path: \\uksprdgisfs01\Data\London\0653313 - Project Accelerator\Maps\0653313 - Project Accelerator - A01.aprx\0653313 - Pathfinder - CH - Pipeline and Cultural Heritage - A01

Designated assets within the Proposed Development

There are no listed buildings, designated registered parks and gardens, conservation areas, scheduled monuments, protected wrecks, world heritage sites or historic battlefields within the Site.

Designated assets within 2 km of the Proposed Development

The following designated assets and present within 2 km of the Proposed Development:

- The Grade II Listed Buildings 'Garton Mill' and Pigeon House are located approximately 1km south and north of the site respectively.
- The Grade II* listed Blue Hall is approximately 1.2km south of the site.
- The Grade 1 listed Church of St Michael and Grade II listed Poplar Farmhouse are both approximately 2km southeast of the site.
- The Aldbrough conservation area[107], which includes four Grade II and one Grade II* listed buildings.

Previous Archaeological Investigations

Previous surveys undertaken as part of the planning process ahead of construction of Aldbrough Phase 1 and as part of Aldbrough Phase 2[108], identified a total of 28 archaeological sites. The most significant of which was a multi-phased Iron Age/Romano British settlement consisting of at least five roundhouses, associated animal enclosures, trackways, and a burial (**Figure 14.1**). This site was located mainly under the existing Aldbrough Phase 1 facility, however a 2006 geophysical survey of the broader area established that it likely extended to the south[109]. An archaeological evaluation undertaken here in late 2007/early 2008 subsequently identified ring ditches and postholes associated with Late Iron Age pottery adjacent and to the north of the southern part of the current Scoping Boundary confirming that the settlement did indeed extend this far south (**Figure 14.1**).

A separate archaeological evaluation conducted in the same year, ahead of the Salt End to Aldbrough Cabling Scheme, also identified a number of linear and curvilinear ditch features in this same area and extending to the south and west that were interpreted as part of an Iron Age field system associated with the settlement site. Following consultation with heritage advisors, a decision was made to preserve the settlement part of the site in situ. This settlement site remains preserved below ground immediately adjacent and to the north of the southern part of the current Scoping Boundary. A watching brief and soil stripping exercise was then undertaken across the remaining part of the field in which this settlement was located (**Figure 14.1**).

A second Romano-British settlement, immediately south of the former location of Ringbrough Farm, was identified during groundworks ahead of cliff stabilisation. The site included a large enclosure, together with pits, postholes, and a kiln. Though the excavated portions are no longer present, it was reported that the features likely extended to the west and, therefore, it is possible that parts of this site are present within the current Scoping Boundary, if they have not already been lost to coastal erosion.

[107] East Riding of Yorkshire Council (2006) *Aldbrough Conservation Appraisal*. Available online: https://www.eastriding.gov.uk/planning-permission-and-building-control/conservation-areas-and-listed-buildings/conservation-areas/conservation-area-appraisals-and-management-plans/

[108] Network Archaeology (1998). UK Gas Storage Facility at Aldbrough, Holderness, Yorkshire: Report on Geophysical Survey.

[109] Geophysical survey also showed that the settlement likely extended to the west of Aldbrough Phase 1 Facility. A trial trench evaluation ahead of the Sproatley to Aldbrough pipeline subsequently identified that the majority of the possible features were, in fact, geological in origin but one burnt rock filled ring ditch feature was recorded that likely marked the western extent of the settlement (AOC (2008) Aldbrough Gas Storage Facility Phase II: Archaeological Trial Trenching).

14.4 Key Sensitivities

Aspects of the historic environment which will be most vulnerable to impacts from the Proposed Development are as follows:

- Archaeological features, artefacts, and deposits: the Proposed Development will be located within a known archaeological landscape, which could be vulnerable to physical disturbance.
- The sensitivity of buried and above ground archaeological material along the coast is heightened by the rapid coastal erosion of up to 4 m per annum[110]. In particular, there is known Iron Age/Romano British and WWII archaeology that is under threat from erosion within the current Scoping Boundary in the area of the former Ringbrough Farm.
- Upstanding cultural heritage assets that draw significance from their setting: there are a number of listed buildings and scheduled monuments within close proximity to the Proposed Development that are potentially vulnerable to an impact on their setting.

14.5 Project Basis for Scoping Assessment

The construction, operation and decommission of the Proposed Development is likely to introduce new and different effects to the historic environment through direct and indirect impacts. In historic environment terms, a direct impact refers to any material alteration of a heritage asset resulting directly from the Proposed Development. Direct impacts are most likely to occur during groundworks associated with construction of above ground installations. Any surface infrastructure also including temporary lay down areas required for construction are likely to involve groundworks, as are below ground services and the construction of landscaping features. Groundworks are likely to remove any buried archaeological deposits they encounter. It should be noted, however, that direct effects within the Site are likely to be limited due to previous groundworks during construction of Aldbrough Phase 1 and during landscaping works that took place following planning approval for Aldbrough Phase 2.

An indirect impact refers to any change in the baseline condition of a heritage asset resulting from a development beyond the Site boundary. Most commonly, indirect impacts involve changes to the setting of heritage sites (considering effects such as visual intrusion, noise pollution, dust, and vibration), though other effects such as changes in water table, can have an impact beyond the Proposed Development boundary. Activities associated with the Proposed Development likely to have an indirect impact on heritage assets beyond the boundary of the AHP Project include the construction, operation and decommissioning of above ground installations and all associated infrastructure.

14.6 Mitigation

Following guidance provided by Historic England, impacts on the historic environment will be avoided in the first instance. If avoidance is not proportionate or possible, and a direct impact is predicted, then recording and investigations to capture evidence from the historic environment will be conducted, and the information gathered made available to the public[111]. If avoidance is not proportionate or possible, and an indirect impact on the setting of the historic environment is predicted, then practical measures to reduce the impact will be developed, following specific guidance provided by Historic England[112].

[110] Atkins (2022) Aldbrough Hydrogen Storage Project: Feasibility Study Report

[111] Historic England (2016) *Preserving Archaeological Remains Decision-taking for Sites under Development.* Available online: https://historicengland.org.uk/images-books/publications/preserving-archaeological-remains/heag100a-preserving-archaeological-remains/

[112] Historic England (revised 2017) *Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets*. Available online: https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/heag180-gpa3-setting-heritage-assets/

14.7 Likely Significant Effects to be considered in the EIA

Table 14-1 below, is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, where appropriate noting actions, including baseline data acquisition, for significant effects scoped in. The basis for scoping out certain effects is presented after the table.

As decommissioning shall be approximately 25 years post start of operation, it will not be addressed to the same level of detail as the other phases and in general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

Table 14-1 Likely Effects – Historic Environment

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Ground disturbance during construction of the potential brine discharge pipe causing potential loss of whole or part of a buried archaeological site	■ Investigation and survey to develop a robust historic environment baseline considered for impact assessment. ■ Input to design process to maximise the avoidance of known features, including the Iron Age site preserved *in situ* following the archaeological investigations for the previously proposed Aldbrough Phase 2 project. ■ Develop written schemes of investigation for the construction phase (in consultation with Humber Archaeological Partnership) to record and report assets that cannot be avoided. ■ Develop procedures for construction to be implemented in the event of chance finds.	Minor to Major	Scoped In	Desk based assessment geophysical survey, geoarchaeological assessment and trial trench evaluation.
Impacts during construction, operation and decommissioning phases on the setting of cultural heritage sites and landscapes	Bunds and tree planting, including maintaining purpose-built landscape screens already constructed for Aldbrough Phase 2.	Minor at most	Scoped In	Preliminary settings assessments to identify any sites that have the potential to be affected by the Proposed Development, followed by a formal settings assessment including zone of theoretical visibility (ZTV) to include long-distance view impacts.

14.8 Effects Scoped out of the EIA

While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

Some parts of the Proposed Development have been subjected to comprehensive archaeological investigation as part of previous planning applications. This includes an area south of East Newton Drain where landscaping works took place following planning approval for Aldbrough Phase 2. In this location, the topsoil and subsoil were removed under archaeological supervision. This area can therefore be scoped out of further assessment.

14.9 Proposed Approach to the Assessment

The assessment will consist of a multi-staged and iterative approach to baseline data gathering, consisting of a DBA, walkover survey, followed by a targeted programme of geophysical and possibly trial trench investigation if appropriate.

The DBA aims to:

- identify all known cultural heritage assets that may be affected by the proposed development including buried archaeological remains and historic buildings historic landscape.
- to identify areas of high archaeological potential; and
- to identify the gaps in the baseline data and potential risks of encountering unknown features during construction of the Proposed Development.

A cultural heritage DBA consists of elements of research and consultation that are typically summarised in a standalone report for inclusion in planning submissions. The DBA will also include the production of GIS data packages that form the spatial framework for subsequent stages of the baseline data gathering programme.

The second stage of this process will be a walkover survey of the Site to confirm the presence and condition of identified receptors and assess potential heritage assets identified from other sources. An initial assessment of archaeological viability will also be undertaken at this time whereby the potential for previously unidentified buried remains will be qualitatively assessed. Walkover surveys will ideally be scheduled to overlap with the DBA research, so they can both inform one another. An initial setting assessment of any site predicted to be affected by the Proposed Development will be undertaken during this walkover survey.

Geoarchaeological investigations and assessments may follow the DBA if deemed appropriate, to allow for a more rigorous understanding of the sub-surface conditions and the potential for buried archaeology to be encountered within the site. Within the area identified for the Proposed Development, it is likely that geoarchaeological work will concentrate on the alluvial deposits and would optimally be programmed and considered alongside any pre-construction engineering works such as Ground Investigation boreholes.

The fourth stage of baseline data gathering will be geophysical investigations, the extent of which will be informed by the results of the preceding stages of investigation.

A fifth stage of baseline data gathering consisting of a programme of trial trenching may be required to establish the nature, extent, character, and significance of any buried archaeological.

14.9.1 Assessment Criteria

Non-designated cultural heritage assets will be considered in addition to the following designated assets:

- scheduled monuments.

- listed buildings.
- protected wrecks.
- world heritage sites.
- conservation areas.
- registered parks and gardens; and
- registered battlefields.

The appraisal will then proceed from a consideration of the importance of a cultural heritage asset and its sensitivity to impacts against the magnitude of any potential change, to arrive at the significance of the effect.

Heritage assets will be assigned a level of heritage value in accordance with a four-point scale presented in **Table 14-2**. This table provides guidance on the elements that contribute to heritage value. Professional judgement will be applied in all cases regarding the appropriate level of value to be assigned to individual heritage assets.

Table 14-2 Criteria to assess the value of heritage assets

Value	Criteria
High	■ World Heritage Sites ■ Grade I and Grade II* Listed Buildings ■ Grade I and Grade II* Registered Parks and Gardens ■ Scheduled Monuments ■ Registered Battlefields ■ Protected Wrecks ■ Conservation Areas (as appropriate) ■ Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens, or landscapes) that can be shown to have demonstrable national, international or universal importance (value) ■ Burial Grounds and Cemeteries ■ Well preserved historic landscape character areas, exhibiting considerable coherence, time-depth or other critical factor(s)
Medium	■ Grade II listed Buildings ■ Conservation Areas (as appropriate) ■ Grade II Registered Parks and Gardens ■ Locally listed buildings as recorded on a local authority list ■ Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to be of regional importance (value) ■ Historic Townscapes with historic integrity in that the assets that constitute their make-up are clearly legible ■ Averagely well-preserved historic landscape character areas with reasonable coherence, time-depth or other critical factor(s)
Low	■ Non-designated heritage assets (archaeological sites, buildings, monuments, parks, gardens or landscapes) that can be shown to be of limited or of local interest only (value) ■ Assets whose values are compromised by poor preservation or survival or of contextual associations to justify inclusion into a higher grade ■ Historic landscape character areas whose value is limited by poor preservation and/or poor survival of contextual associations
Not important	■ Assets identified as being of no historic, evidential, aesthetic or communal interest ■ Assets whose values are compromised by poor preservation or survival or of contextual associations to justify inclusion into a higher grade

	■ Landscape with no or little significant historical interest

Magnitude is a measure of the nature of the expected impact and will be classified for direct and indirect effects (

Table 14-3**).** For the purposes of visual assessment, proximity to the Proposed Development (within the zone of theoretical visibility) will be taken as one of the determining attributes.

Table 14-3 Factors influencing assessment of magnitude of impact

Impact rating	Description of impact
Large	■ Change such that the significance of the asset is totally altered or destroyed. Comprehensive change to setting affecting significance, resulting in changes in our ability to understand and appreciate the asset and its historical context and setting
Medium	■ Change such that the significance of the asset is affected. Changes such that the setting of the asset is noticeably different, affecting significance resulting in changes in our ability to understand and appreciate the asset and its historical context and setting
Small	■ Change such that the significance of the asset is slightly affected ■ Changes to the setting that have a slight impact on significance resulting in changes in our ability to understand and appreciate the asset and its historical context and setting
Minimal	■ Changes to the asset that hardly affect significance. Changes to the setting of an asset that have little effect on significance and no real change in our ability to understand and appreciate the asset and its historical context and setting
No change	■ The Project does not affect the significance of the asset. ■ Changes to the setting that do not affect the significance of the asset or our appreciation of it

Where potential scores of moderate or major significance are predicted for asset using the matrix-based approach mitigation measures will be recommended.

When considering potential impacts on setting, a definition of the setting of each asset will be provided, considering its designation status, essential attributes etc. An assessment will be made using professional judgement of the extent to which that setting is affected by the Proposed Development.

15. SOCIO-ECONOMIC CHARACTERISTICS

15.1 Introduction

This section of the Scoping Report addresses the approach to the assessment of socio-economic effects associated with the Proposed Development. Socio-economic impacts can be considered, simplistically, to be something which has either a perceived or corporeal effect on the social and/or economic structure of the receiving environment at any level. These levels can range from an individual person, through an economic unit (such as a household) to an entire community or beyond.

The assessment of socio-economic effects is closely associated with the Population and Human Health components of the EIA. Therefore, there will be a degree of commonality or overlap in the data sets used to inform the development of an environmental baseline, undertake the assessment of potentially significant effects, and determine the requirement for mitigation – should it be appropriate. This will include the community profile developed as part of the Population and Human Health section. It is not anticipated that primary data collection will be undertaken for either assessment.

15.2 Topic specific Regulatory Requirements and Guidance

There are no legislative requirements which dictate the form of socio-economic assessment, therefore, the approach adopted will be informed by best practice and feedback from stakeholders collated through the engagement and consultation activity undertaken to inform the Proposed Development and the EIA.

15.2.1 Temporal Scope

The assessment will consider the construction, operational and decommissioning phases of the Proposed Development. The construction phase is anticipated to last 36 months, commencing in Q1 2024. The Proposed Development is expected to have an operational lifespan of 25 years. These dates provide the primary temporal scope for this assessment; however, consideration will also be given to the potential for potential impacts associated with the Proposed Development to extend beyond this period.

15.2.2 Geographical Scope

The proposed study area has been determined by consideration of the extent and characteristics of the Proposed Development, the communities and other receptors anticipated to be directly and/or indirectly affected and the potential for interaction with the wider regional economy.

The Proposed Development is set within a brownfield site, located within the ERYC area, in the civil parish of Aldbrough in the Yorkshire and Humber region. The largest proximal settlement to the Proposed Development is Aldbrough, which is approximately 2 km north-west of the Site. The more immediate receiving environment comprises a mixture of agricultural land-use, with scattered residential and commercial properties, and three small settlements. These comprise East Newton, circa 700 m to the north, Garton approximately 1.6 km to the south and Grimston approximately 2.5 km to the south.

Given the spatial disassociation of the Proposed Development from direct interaction with most potential receptors, combined with the disaggregated nature of anthropogenic receptors in the receiving environment, this assessment will comprise two primary spatial scales. These being Lower-Level Super Output Area (LSOA) 021A (Government Statistical Service Code E01013029), which comprises the Site and surrounding area, and the Mid-Holderness Ward which comprises a much larger area extending approximately from Burstwick at the southern extent to Catwick at the north and from the coast to the eastern periphery of Kingston upon Hull.

LSOA are small areas designed by the Office of National Statistics (ONS) to be approximately the same size – usually comprising circa 1,500 people or 650 households – to facilitate comparative analysis and reporting. Wards are electoral districts at sub-national level and represent the primary

unit of English electoral geography and as such share the same statistical data sets as LSOAs but cover broader geographic areas.

It is anticipated that potential social impacts will be limited to a geographic envelope comprising an area less than the footprint of LSOA 021A, however, for robustness it is proposed potential social effects are assessed at this scale. Economic effects have the potential to be further reaching and for this reason it is proposed to assess these at the ward level. Additional consideration will be given to receptors which may be affected by the agreed haul route.

15.2.3 Data Sources used in Scoping

The following data sources have been used to inform an understanding of the baseline conditions described:

- East Riding of Yorkshire Population Estimates (East Riding of Yorkshire Intelligence Hub, 2020[113]);
- Office for National Statistics Labour Market Profiles (NOMIS) (Nomis, 2020[114]);
- Data East Yorkshire (East Riding of Yorkshire Intelligence Hub, 2020[115]);
- English Indices of Deprivation (Ministry of Housing, Communities and Local Government, 2019[116]);
- East Riding Local Plan 2021 – 2029 (East Riding of Yorkshire Council, 2016[117])
- Projected job creation estimates.

Additionally, as previously noted, the socio-economic assessment will draw upon the community profile which will be developed to support the assessment of the Proposed Development, in particular the Population and Human Health section. The community profile will evolve as the assessment progresses and will also draw upon feedback from stakeholders.

15.3 Baseline Environment

15.3.1 Population and Demographics

To contribute to the understanding of the environmental baseline for this assessment, population and demographics will be considered, particularly in relation to the community profile which will be developed.

As a precis, the mid-2020 population estimate for the S021A LSOA was 1,454, representing a slight downturn from the 2011 census data which reported 1,468. The mid-2020 population estimate for the Mid Holderness Ward is 13,769 which has also seen a marginal decrease since the 2011 census which reported 13,836 individuals. In terms of wider demographics and associated trends there is broad parity between this LSOA and ward and as such it is proposed they represent an appropriate baseline for assessment. Additionally, it is considered that they are both broadly representative of the adjoining and wider area should further comparison be required.

[113] East Riding of Yorkshire Intelligence Hub (2020) *Data Explorer*. Available online: https://intel-hub.eastriding.gov.uk/data-catalog-explorer/indicator/I351
[114] Office for National Statistics (2020) *Nomis: local authority profile*. Available online: https://www.nomisweb.co.uk/reports/lmp/la/contents.aspx
[115] East Riding of Yorkshire Council (2020) *East Riding Intelligence Hub.* Available online: https://intel-hub.eastriding.gov.uk/
[116] Ministry of Housing, Communities and Local Government (2019) *English indices of deprivation 2019.* Available online: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019
[117] East Riding of Yorkshire Council (2016) *East Riding Local Plan (adopted April 2016)*. Available online: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/east-riding-local-plan/

15.3.2 Economy and Employment

As reported in the 2011 census, 68.9% of the population in Mid Holderness Ward was economically active in some form of employment (full/part-time and self-employed). Retirees comprise 20.6% of the population with 10.5% of the population economically inactive for other reasons. These trends are mirrored closely at the LSOA level.

Within the study area the dominant form of employment is within skilled trades such as agriculture, forestry, fishing and repair of motor vehicles and motorcycles. However, it appears, a larger proportion of the population in the study area is retired compared to the national average. It is acknowledged that the economic activity of the population is relevant to understanding the potential interaction of the Proposed Development with the local job market, the provision and availability of services as well as providing context for the potential influx of workers. As a result, the economic baseline will be determined and used to support the assessment of effects.

15.3.3 Tourism

In the County of East Riding, and at a more granular level, the role that tourism plays in the local economy varies widely. The focus for tourism in the wider area is along the coast, primarily centred on the towns and villages of Bridlington, Hornsea and Withernsea, with Beverley providing an inland focal point for rural tourism around the Yorkshire Wolds. The most proximal tourism receptors in relation to the Proposed Development comprise a caravan park at East Newton circa 700 m to the north, the Bailwood Scout Campsite circa 350 m to the west, Aldbrough Leisure Park circa 2 km to the north and Aldbrough itself. Beyond these receptors there is limited tourism value within either spatial scale of the study area. That said, the East Riding Economic Strategy 2018-2022[118] states that it will "continue to develop and support nature tourism opportunities". This is to be achieved through;

'enhancing the tourism accommodation offer and making use of town centres, seaside resorts, coastal areas and the countryside, including the area's natural features and the rich heritage of the landscape, nature conservation sites and built environment as set out in the East Riding Local Plan 2012 – 2029.'

Given that tourism may represent cross-sectional employment the tourism receptors will form part of the environmental baseline underpinning the assessment.

15.3.4 Transport Links

The assessment will include specific consideration of any key travel routes and the potential for significant effects on sensitive receptors in the receiving environment arising from its use.

As noted in the traffic and transport section, a designated haulage route has been previously approved for construction and operational traffic access to the site of the Proposed Development. The approved route makes primary use of the A165, the B1238 (Hull Road), and the B1242 (Aldbrough Road) to the east, where the main access to the Proposed Development will be located.

The route includes the provision of a link road connecting the B1238 and the B1242, to prevent construction vehicle movements within the village of Aldbrough. The route does, however, pass directly through four settlements between the Proposed Development and Kingston upon Hull, including Flinton, Sproatley, Wyton, and Bilton, with these communities likely to experience increased traffic associated with construction and operation of the Proposed Development.

Additionally, the alternative method for the transport and disposal of the brine required for flushing the subterranean caverns, is to employ a designated haul route rather than the discharge pipe to offshore diffuser option. This will comprise use of the A165 and B1242 to transport the brine from SSE Hornsea to SSE Atwick. The exact number of vehicle movements are not currently known and further

[118] East Riding of Yorkshire Council (2022) *Economic development: What is the Economic Strategy?* Available online: https://www.eastriding.gov.uk/council/plans-and-policies/other-plans-and-policies-information/economic-development/

assessment is required to determine the optimal transport pattern to avoid significant negative effects on receptors. As an example, however, there is an estimated 60,000 cubic metres of brine to be moved which could result in 20 (2 way) vehicle movements per day over a period of 4 months, operating on a 6 day week. Particular consideration will be given to the interaction of the proposed haul routes with receptors.

The communication of information surrounding the designated traffic route, estimated duration of disruption, and affected areas, listed above, will also be of high importance to local communities and will be included in stakeholder engagement and consultation material. A detailed Traffic Management Plan will be developed and communicated to local stakeholders.

15.3.5 Residential Properties

Given the potential for the Proposed Development to result in an influx of workers during construction and operation from outside the study area, the assessment will consider the potential for significant effects on the local housing and rental market.

15.3.6 Wider Local Receptors

The assessment will, where data allows, map and consider the potential for significant effects on local receptors through disruption to key local services and amenities.

The assessment will also draw upon direct engagement and feedback with stakeholders to help inform and shape this assessment.

15.4 Likely Significant Effects to be considered in the EIA

The socio-economic assessment will consider the following scope of issues and potential effects:

- job creation and training opportunities.
- expenditure in the local economy and effects on local markets.
- provision of services and effects on local services and amenities.
- transport; and
- the contribution an influx of non-local workforce may have.

Broader social, health and population related effects are considered in the Population and Human Health section.

15.5 Effects Scoped out of the EIA

Flaring of Hydrogen may be used for safe shutdown, emergency and maintenance purposes to minimise emissions of hydrogen to atmosphere and/or to ensure safety. This flaring will arise from vent point(s), sited within the footprint of the Proposed Development. Given the rural nature of the receiving environment and the limited number of potential receptors, comprising relatively small camping and caravanning sites, and the intermittent use of flaring it is not anticipated this will result in significant effects. As a result, it is recommended that this be scoped out of further assessment.

Whilst it is not anticipated the Proposed Development will result in significant effects, it is not possible to fully scope out any of the other effects identified at this stage.

15.5.1 Proposed Approach to the Assessment

The socio-economic assessment will determine the:

- number and nature of key receptors through the use of existing data sets and liaison with stakeholders.
- sensitivity of identified key receptors.

- magnitude of impacts; and
- significance of effects.

As there are no standard, recognised criteria or thresholds for the assessment of significance in terms of socio-economic impacts within EIA the assessment will draw on as much empirical data as possible to inform the assessment, as well as industry best practice – such as IEMA guidelines, but will ultimately rely on professional judgement.

The definitions of receptor sensitivity, magnitude, and significance presented Table 15-1, Table 15-2 and Table 15-3 respectively are based on professional judgement and precedent set in similar assessments.

15.5.2 Socio-economic Receptor Sensitivity

For economic effects (including employment), the availability of labour and skills is critical in accommodating the demands, needs and requirements of the Proposed Development. Adequate capacity, i.e. a sufficient labour supply in an area, results in a low sensitivity; while limited capacity results in a high sensitivity. For social effects, receptor sensitivity is principally defined by the ability of the social receptor to absorb or adapt to change and/or the level of usage by sensitive or vulnerable social groups. These are defined in **Table 15-1**.

Table 15-1: Socio-economic Receptor Sensitivity

Sensitivity	Description
High	There is no or low availability of labour and skills in the local authority area workforce, for example as a result of very low unemployment rates. The Proposed Development would lead to labour market pressure and distortions (i.e. skills and capacity shortages, import of labour, wage inflation). The receptor is of international or national importance and/or has little or no ability to absorb change or recover/adapt and/or is solely used by sensitive groups such as older people, children, and people of poor health.
Medium	The area has a constrained supply of labour and skills. The Proposed Development may lead to labour market pressure and distortions. The receptor is of regional or local importance and/or has medium ability to absorb change or recover/adapt and/or is principally used by sensitive groups such as older people, children, and people of poor health.
Low	The area has a readily available labour force with some skill deficits. The Proposed Development is unlikely to lead to labour market pressure and distortions. The receptor is of local importance and/or has ability to absorb change or recover. It may also be used by sensitive groups such as older people, children, and people of poor health.
Very Low/ Negligible	An effect would not be discernible in the context of the number of jobs created or lost within the local authority area and the capacity of that area to accommodate the change. The receptor is of local importance and/or is able to absorb change and/or recover or adapt to the change and is not specifically for use by sensitive groups such as older people, children, and people of poor health.

15.5.3 Magnitude of Impacts

The magnitude of impacts is determined by the extent of the change and the scale of the impact. A level of impact magnitude (see **Table 15-2**) will be assigned taking into consideration the following:

- extent of change – taking account of the number of people affected and the size of the area impacted upon; and
- scale of the impact – whether permanent during operation or temporary/short-term during construction.

Table 15-2 Magnitude of Impact (adverse and positive)

Impact Magnitude	Description
Large	The impact would dominate the baseline conditions. Effects would be experienced at an international or national scale. Constitutes a long-term change to baseline. Effects would be of long-term duration (greater than 5 years or continuous i.e. permanent and irreversible) Major effect on large numbers of businesses, employment creation or well-being of receptors/local people (with number depending on the local context).
Medium	A medium-term impact on the baseline conditions (i.e. 3-5 years). Effects would be experienced at a regional, or sub-regional scale. Moderate effect on businesses, employment creation or well-being of receptors/local people (with number depending on the local context).
Small	A short-term impact on the baseline conditions (i.e. 1-2 years). Effects would be experienced at a local level. Minor effect on businesses, employment creation or well-being of receptors/local people (with number depending on the local context).
Very Small/ Negligible	A very short-term/temporary change to the baseline (i.e. < 1 year). Any impacts would be experienced at a local level. Slight/no impact on businesses, employment creation or well-being of receptors/local people (with number depending on the local context).

15.5.4 Significance of Effects

The level of significance is determined by the sensitivity of the receptor and magnitude of the impacts upon them (see **Table 15-3**). For the purposes of the assessment and the EIA Regulations, 'significant effects' are those identified as being moderate or major (adverse or beneficial). Minor effects or lower are not considered to be 'significant'.

Table 15-3 Significance of Effect

		Sensitivity of Receptors			
		High	**Medium**	**Low**	**Very Low/ Negligible**
Magnitude of Impact	**Large**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Not Significant
	Small	Moderate	Minor	Not Significant	Not Significant
	Very Small/ Negligible	Minor	Not Significant	Not Significant	Not Significant

The significance of effects will be assessed relative to the baseline. The effects are qualified as being:

- Beneficial – advantageous or beneficial on an impact area/defined receptor; and
- Adverse – disadvantageous or negative effect on an impact area/defined receptor.

15.6 Mitigation

Should significant effects be established, relevant mitigation measures will be identified. These measures may include:

- mitigation measures from other environmental topics, including Landscape and Visual, Air Quality, and Noise and Vibration;
- an ongoing programme of stakeholder engagement, community liaison and/or information provision; and

- the provision of a CEMP including detailed Traffic Management Plan, which will address potential concerns around effects on the local road network and any concerns over potential secondary effects on local businesses and residents.
- Mitigation will be identified and discussed with stakeholders, as appropriate, as the assessment evolves.

16. POPULATION AND HUMAN HEALTH

16.1 Introduction

This section of the Scoping Report describes how the EIA will address potential effects on the health and wellbeing of communities in the vicinity of the Proposed Development, during pre-construction, construction and operational phases. The consideration of pre-construction activity is included in this assessment pursuant to best practice and in acknowledgement of potential impacts which may arise to human health and wellbeing during this stage of the Proposed Development design, when communities become aware, engaged and contribute to the evolving scheme design and assessment.

The aim in undertaking this work is to provide all interested parties with a comprehensive evaluation of the Proposed Development's implications for health and wellbeing, and specifically to:

- determine the potential health and wellbeing impacts of the Proposed Development on local communities.
- assess the nature and extent of these health and wellbeing impacts, both negative and beneficial in nature.
- identify opportunities to enhance positive health and wellbeing impacts and minimise negative impacts; and
- inform the planning process and consideration of consenting conditions, specifically in relation to health and wellbeing issues.

The assessment is closely interrelated with other topics and will draw upon the findings of wider technical assessments being undertaken as part of the EIA process, these include socio-economic, noise, air quality, landscape and visual, and traffic and transport assessments. Cross-reference will, therefore, made to these assessments as appropriate.

16.2 Topic specific Regulatory Requirements and Guidance

16.2.1 Regulatory requirements

There is no statutory requirement to carry out a standalone Health Impact Assessment (HIA) for the Proposed Development. The amended EIA Directive (2014/52/EU) does, however, include the requirement to consider the likely significant effects of projects on 'population and human health'. Evolving practice has, therefore, seen the integration of previously standalone assessments of human health and wellbeing into EIA reporting, consistent with the Directive.

The assessment will be undertaken pursuant to the EIA Directive and the continued application of EIA in the UK, post-Brexit, as set out in The Environmental Assessments and Miscellaneous Planning (Amendment) (EU Exit) Regulations 2018.

16.2.2 Guidance

An array of international and UK guidance exists on the assessment of human health and wellbeing; some examples of which are listed below.

- Learning from practice: case studies of health in strategic environmental assessment and environmental impact assessment across the World Health Organisation WHO European Region, 2022[119].

[119] WHO (2022) *Learning from practice: case studies of health in strategic environmental assessment and environmental impact assessment across the WHO European Region. Executive summary*. Available online at: https://www.who.int/europe/publications/i/item/WHO-EURO-2022-4882-44645-63360

- Human health: Ensuring a high level of protection. A reference paper on addressing Human Health in Environmental Impact Assessment, European Public Health Association, 2020[120].
- Health Impact Assessment in Spatial Planning, Public Health England, 2020[121].
- Rapid Health Impact Assessment Tool, NHS HUDU, 2019[122].

The guidance sets out the approach and expectations of how an assessment of human health and wellbeing should be conducted, drawing upon precedent and learnings from assessment work conducted to support an array of international, national, regional, and local level projects.

Consistent across the guidance documents, is the expectation that a comprehensive approach be adopted to consideration of the range of potential factors, known as determinants, which impact human health and wellbeing. The role of stakeholder feedback is also recognised as a key consideration in identifying impacts and appropriate mitigation.

The assessment will reflect the learnings and recommendations set out in the guidance and will also be informed by the literature review which is being conducted to inform the detailed assessment of impacts.

16.2.3 Methodology

The WHO defines health as; "*a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*".

Consistent with best practice, this assessment will consider both physical and mental health considerations and the range of determinants which impact human health and wellbeing in its identification of potential impacts arising from the Proposed Development.

A health determinant can be any factor which has the potential to influence the health of an individual. This assessment will consider the following categories of determinants to inform the identification of potential impacts. These are set out in **Figure 16-1**.

[120] EUPHA (2020) *Human health: Ensuring a high level of protection*. Available online: https://eupha.org/repository/sections/HIA/HumanHealthEnsuringProtectionSummary.pdf
[121] Public Health England (2020) *Health Impact Assessment in spatial planning*. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/929230/HIA_in_Planning_Guide_Sept2020.pdf
[122] NHS (2019) *HUDU Planning for Health*. Available online: https://www.healthyurbandevelopment.nhs.uk/wp-content/uploads/2019/10/HUDU-Rapid-HIA-Tool-October-2019.pdf

Figure 16-1 Health Map for the Local Human Habitat

Source: Barton, H. and Grant, M. (2006) A health map for the local human habitat. The Journal for the Royal Society for the Promotion of Health, 126 (6). pp. 252-253. ISSN 1466-4240 developed from the model by Dahlgren and Whitehead, 1991.Dahlgren G, Whitehead M (1991). "The main determinants of health" model, version accessible in: Dahlgren G, and Whitehead M. (2007) European strategies for tackling social inequities in health: Levelling up Part 2. Copenhagen: WHO Regional Office for Europe.

Within this report the health determinants have been grouped into the following overarching categories:

- Physical Environment: comprises determinants which are part of the natural and built environment, their physical characteristics, and conditions in so far as this is relevant to this assessment.
- Economics: comprising the economic conditions of an area, the resilience of local markets and the inherent activities and opportunities this supports
- Community: comprising determinants such as the social capital, social networks, norms and customs as well as key information regarding the local demographic; and
- Living Environment: describing the relationship and sense of character the community associate with the area.

Consideration of the range of these key categories of determinants will enable a comprehensive assessment to be undertaken of the range of potential effects which may be experienced.

The approach to assessment of human health and wellbeing will include the following key stages:

- definition of geographic scope and establishment of the baseline, including the development of a detailed community profile and literature review.
- engagement with key stakeholders to help inform the identification of potential impacts.
- assessment of how the Proposed Development potentially impacts the range of determinants affecting health and wellbeing; and
- identification of mitigation and assessment of residual impacts.

16.2.4 Geographic Scope

For the assessment of impact on human health, the study area has been determined by the extent and characteristics of the Proposed Development and the communities likely to be directly and indirectly affected. Given the interlinked nature of the socio-economic assessment and this section it

is proposed to use the same dual study area comprising LSOA 021A and the Mid Holderness Ward. It is anticipated that direct effects, should they occur, are likely to be present within a sub-area of the LSOAs footprint with the potential for less tangible or indirect effects to be present across the broader geographic study area of the ward.

16.2.5 Data Sources used in Scoping

The following data sources have been used to inform the scoping assessment and will be further used to develop the detailed community profile and assessment of potential effects on human health and wellbeing of the Proposed Development:

- the Office for National Statistics (ONS, 2021);
- English Indices of Deprivation (Ministry of Housing, Communities and Local Government, 2019[123]);
- Public Health England, Public Health Profiles (Public Health England, 2019);
- East Riding of Yorkshire Intelligence Hub.
- East Riding Local Plan 2021-2029 and information collated by the Council; and
- Health and Wellbeing Strategy 2019-2022 (East Riding of Yorkshire Council, 2019)[124].

A detailed community and health profile will be developed to support the evolving assessment. Both the profile and subsequent assessment will draw on the findings of wider environmental assessments, including in particular the air quality, traffic and transport, noise and vibration and socio-economic assessments to inform the profile and baseline conditions for the assessment and overarching assessment of cumulative effects.

16.3 Baseline Environment

The baseline will be established using a combination of data sources, as outlined above. Further detail for the proposed health determinants to be extracted from these data sources is provided in the paragraphs below

16.3.1 Physical Environment

The physical environment within which the Proposed Development is sited, is detailed in full within the other sections of this report and will not be replicated here. This assessment will however, draw upon the baseline and assessment of effects on the physical environment to understand what potential effects this may have on the health and wellbeing of local communities.

In particular consideration of air quality, dust, noise, vibration, land-use, contaminated land, transport and access will be considered in this section for their potential to act as health determinants.

As noted in the traffic and transport section, a designated haulage route has been previously approved for construction and operational traffic access to the site of the Proposed Development. The approved route makes primary use of the A165, the B1238 (Hull Road), and the B1242 (Aldbrough Road) to the east, where the main access to the Proposed Development will be located.

The route includes the provision of a link road connecting the B1238 and the B1242, to prevent construction vehicle movements within the village of Aldbrough. The route does, however, pass directly through four settlements between the Proposed Development and Kingston upon Hull, including Flinton, Sproatley, Wyton, and Bilton, with these communities likely to experience increased traffic associated with construction and operation of the Proposed Development.

[123] Ministry of Housing, Communities and Local Government (2019) *Indices of Deprivation*. Available online: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019
[124] East Riding of Yorkshire Council (2019) *Health and Wellbeing Strategy 2019-2022*. Available online: https://www.eastriding.gov.uk/council/committees/health-and-wellbeing-board/

Additionally, the alternative method for the transport and disposal of the brine required for flushing the subterranean caverns, which will be used for gas storage, is to employ a designated haul route rather than the discharge pipe to offshore diffuser option. This will comprise use of the A165 and B1242 to move the brine from SSE Hornsea to SSE Atwick. The exact number of vehicle movements are currently unknown and further assessment is required to determine the optimal transport pattern to avoid significant negative effects on receptors. As an example, however, there is an estimated 60,000 cubic metres of brine to be moved which could result in 40 vehicle movements per day over a period of 4 months, operating on a 6 day week. Particular consideration will be given to the interaction of the proposed haul routes with receptors.

The communication of information surrounding the designated traffic route, estimated duration of disruption, and affected areas listed above, will also be of high importance to local communities and will be included in stakeholder engagement and consultation material. A detailed Traffic Management Plan will be developed and communicated to local stakeholders.

16.3.2 Socio-Economic Deprivation

Whilst the primary consideration of economic effects, such as economic activity etc. will occur in the Socio-Economics section the consideration of deprivation as a health determinant will be included in this section.

Deprivation has been associated with poor personal and societal wellbeing and a reduced quality of life, health and wellbeing. In 2019, the Index of Multiple Deprivation showed that some areas within East Riding were in the 10% most deprived in the country. For Mid Holderness the areas surrounding Aldbrough are within the 30-40% most deprived, the worst score for the ward.

Areas of increased deprivation within the council create health inequalities and consideration of the potential for the proposed development to affect deprivation will be included in the EIA.

16.3.3 Community

The study area comprises largely rural communities interspersed with more densely populated settlements the closest of which is Aldbrough. It is accepted that developments may affect the structure and functioning of communities, under some circumstances. As such an effort will be made to assess the existing social capital, social networks, norms and customs of communities which may be affected by the proposed development. This will use publicly available data and it is not anticipated that primary data collection will be necessary beyond the proposed stakeholder engagement programme.

In addition, key information regarding the local demographic will be collated in the detailed community health profile which will form a component of the baseline.

16.3.4 Living Environment

The communities in and around Aldbrough are accustomed to having the existing gas storage facility operations in relatively proximity, as well as industrial sites in the wider area, including Saltend Chemicals Park. As noted in the Stakeholder Engagement and Consultation section, whilst this brings familiarity with industry, it does not preclude potential concerns over further development or redevelopment at the site and how this may affect local communities' interaction with the area.

16.3.5 Stakeholder Engagement

Whilst the majority of the assessment will rely on publicly available sources of data some primary data collection for this assessment may arrive through the stakeholder engagement process. Relevant stakeholders will be consulted and their input fed into the baseline and assessment components of this section.

16.3.6 Assessment Criteria

The assessment will consider the effects of the Proposed Development during the construction and operational phase within the context of the policy framework and existing/future baseline conditions.

Assessment will be made using both qualitative and, where possible, quantitative methods. The assessment will consider the health determinants above. Given that there is no published assessment guidance or technical significance criteria to determine impacts on population and human health it is anticipated that the majority of the assessment will rely on professional experience and judgement. Where possible a standard matrix of significance will be applied.

16.3.7 Mitigation and Residual Effects

Similarly, as there are no published assessment guidance and technical significance criteria for the primary assessment there are none for the assessment of residual effects or the determination of appropriate mitigation. Accordingly, the evaluation of effects will be undertaken based on professional experience and judgement, having regard to the existing baseline position.

Mitigation measures will be recommended where any significant adverse effects are anticipated. Residual effects will be assessed and clearly set-out in the ES.

Consideration will be given to inter-project cumulative effects, subject to availability of cumulative scheme information in the public domain

16.3.8 Key Sensitivities

The following receptors are considered most likely to receive potential effects arising from the Proposed Development:

- Residential receptors in close proximity to the Proposed Development site.
- Residents living in the wider communities such as Aldbrough, particularly in relation to the proposed haul routes.
- Local economic receptors (i.e. local businesses who may provide services or accommodation, either through supply chain linkages or accommodation to construction employees, development land and agricultural land);
- Community receptors (i.e. publicly accessible routes and PRoW used for recreation, and community land and assets).

As the community profile develops, the identification of sensitive community receptors will evolve. This will also be informed by feedback from stakeholders, additional data sources and collated from engagement and other consultation activities.

16.4 Likely Significant Effects to be considered in the EIA

The design and location of the Proposed Development will seek to minimise potential impacts on population and human health resulting from the development.

16.5 Effects Scoped out of the EIA

Flaring of Hydrogen may be used for safe shutdown, emergency and maintenance purposes to minimise emissions of hydrogen to atmosphere and/or to ensure safety. This flaring will arise from vent point(s), sited within the footprint of the Proposed Development. Given the rural nature of the receiving environment and the limited number of potential receptors, comprising relatively small camping and caravanning sites and scattered communities, and the intermittent use of flaring it is not anticipated this will result in significant effects. As a result, it is recommended that this be **scoped out** of further assessment.

16.5.1 Proposed Development

The key elements of the Proposed Development from a health perspective, are anticipated to be changes in the physical environment arising from the operation of the proposed development and temporary effects arising during the construction phase. It is not anticipated that the proposed development will result in significant effects on structure and function of local communities or changes to the economy through the lens of deprivation, however, at this stage it is not possible to fully scope these elements out of the assessment.

16.5.2 Potential Effects

A summary of potential impacts is set out in Table 16-1 Summary of potential effects to be assessed Table 16-1 below.

Table 16-1 Summary of potential effects to be assessed

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Changes in the physical environment as discussed. Particularly of relevance to local residential and commercial receptors and those associated with the proposed haul routes.	Construction management planning (CEMP) and liaison with local stakeholders and community	Direct effects on corporeal health and indirect effects on wellbeing	Scope In	Proposed design Maximum development parameters
Visual impacts arising from construction activity and the presence of new operational facilities at the Proposed Development	Temporary and/or permanent in duration	Effect on residents living in closest proximity to the Proposed Development at Aldbrough. Effect on local leisure business on coastline from offshore activities.	Scope In	Proposed design Maximum development parameters
General disruption/change to community life, provision of services and social capital etc. caused by construction – particularly through transport	Engagement and the Draft COCP	Disruption to community life and social capital caused, in particular, during construction phase. Temporary in duration	Scope In	New traffic flow data for roads and junctions within the study area
Changes in levels of deprivation as a result of the proposed development	Changes to the local job market and service provision, including enhancement in the form of local procurement of	Direct and in direct employment, upskilling and inward investment giving rise to enhanced quality of life. Temporary and permanent in duration.	Scope In	N/A

	goods, services and people			
Impact on local businesses. Including additional provision of services, disruption to services etc.	Construction management planning and liaison with local stakeholders and community	Effect on those living in closest proximity to the proposed traffic route, currently projected to that stipulated in the Traffic Management Plan for the Site. Temporary in duration	Scope In	N/A

It is important to note that in addition to the impacts and potential effects listed in the table, the assessment will also consider the cumulative effect on human health and wellbeing. This will be identified working in conjunction with wider technical assessment teams to ensure that there is a thorough consideration of the range of potential impacts, mitigation and residual effects which affect human health.

16.6 Mitigation

Relevant mitigation measures will be identified through the EIA and will be supported by information gleaned through engagement with stakeholders. These measures may include:

- Mitigation measures from other environmental topics, including Landscape and Visual, Air Quality, and Noise and Vibration.
- Specific measures identified as a result of this assessment.
- A detailed ongoing programme of stakeholder engagement, community liaison and information provision, in particular, in advance of commencement of the construction phase to alleviate concern and anxiety.
- The provision of a CEMP including detailed Traffic Management Plan, which will address potential concerns around effects on the local road network and any concerns over potential secondary effects on local businesses and residents.

Mitigation will be identified and discussed with stakeholders, as appropriate, as the assessment evolves.

17. MAJOR ACCIDENTS AND DISASTERS

17.1 Introduction

This section addresses potential major accidents and disasters which could affect people or the environment. It also provides a brief overview of relevant elements of the Proposed Development and details the proposed approach to assessing the likelihood of events occurring, their severity and the likely significance of effects.

17.2 Topic-specific Regulatory Requirements and Guidance

17.2.1 EIA Regulations

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[125] (as amended) (Infrastructure EIA Regulations 2017) requires a Major Accidents and Disasters (MA&D) Assessment to identify potential significant adverse effects of the Proposed Development on safety and the environment.

At this stage, the scoping exercise has not sought to identify likely significant effects. To do so requires a combination of sufficient design information and working alongside the design team on hazard identification. The MA&D Assessment activities will be carried out in future stages of the EIA.

17.2.2 Control of Major Accident Hazards

The principal health and safety legislation covering onshore storage of hazardous gases underground is the COMAH Regulations 2015[126]. The COMAH Regulations provides a framework for the regulation of establishments where there is potential for a major accident to people or to the environment to occur. The COMAH Regulations requires the operators to take all measures necessary to prevent major accidents and limit their consequences.

Underground gas storage facilities are within the scope of the COMAH Regulations if the quantity of flammable gas stored meets or exceeds the thresholds in Schedule 1, Part 2 of the Regulations. For hydrogen, this threshold is 5 tonnes (lower-tier) and 50 tonnes (upper-tier). Based on the expected storage capacity, the Proposed Development will be an upper-tier COMAH site.

The Proposed Development (i.e. Electrolyser, OCGT, salt cavities, wellheads, interconnecting pipework and import and export processing facilities, including compressors), will together comprise the COMAH establishment.

The COMAH Regulations requires upper-tier sites to prepare a safety report as part of their demonstration that all measures necessary have been taken to prevent major accidents and to limit the consequences to people and the environment of any that do occur. The safety report for the existing Aldbrough Gas Storage site will be updated to include the Proposed Development.

The updated safety report is required to be submitted to the competent authority in a reasonable time before commencing operation (e.g. 3 to 6 months). The report must address the criteria set out in the Safety Report Assessment Manual (SRAM)[127] for technical, predictive, descriptive, environmental and emergency response criteria.

The COMAH Regulations also requires upper-tier operators to prepare and test an on-site emergency plan, as well as supplying information to the local authorities and public to enable off-site emergency plans to be developed.

[125] HM Government (2017) *Infrastructure Planning (Environmental Impact Assessment) Regulations*. Available at: https://www.legislation.gov.uk/uksi/2017/572/contents/made
[126] HM Government (2015) *The Control of Major Accident Hazard Regulations*. Available at: https://www.legislation.gov.uk/uksi/2015/483/contents/made
[127] Health and Safety Executive (2015) *Safety Report Assessment Manual (SRAM) – 2015*. Available online: https://www.hse.gov.uk/comah/sram/docs/comah-sram-2015.pdf

The existing storage and processing facility (Aldbrough Phase 1) is an upper-tier COMAH site due to the inventory of natural gas. Hazards potentially impacting on either of the adjacent sites will require consideration as part of the COMAH compliance, including ALARP demonstration and emergency response.

17.2.3 Land Use Planning and Hazardous Substances Consent

Hazardous Substances Consent (HSC) is required to be obtained from the Hazardous Substances Authority (HSA), typically the Local Planning Authority (LPA), who then must consult the HSE on these applications to consider whether the presence of a significant quantity (referred to as the 'Controlled Quantity') of a hazardous substance is acceptable in a particular location.

The application must detail the expected inventory of the identified hazardous substances to be processed, stored and/or transferred (received/offloading/shipped) and expected applicable measures, methods for use/storage/transfer, as prescribed in the HSC application form.

In assessing the application for consent, HSE will produce a map with three risk contours (or zones), representing defined levels of risk or harm which any individual would be subject to. Should the HSA grant consent, this map defines the consultation distances within which HSE must be consulted over any relevant future planning applications.

17.2.4 Borehole Safety

The Boreholes Safety and Operations Regulations 1995[128] and The Offshore Installations and Wells (design and construction etc.) Regulations 1996[129] apply to activities or operations in connection with the extraction of minerals by a borehole, including the construction of caverns in salt formations by solution mining.

The regulations include requirements for drilling operations, well maintenance, and other general operations. The regulations require operators to notify the HSE at least 21 days in advance of drilling activities.

17.2.5 Other Relevant Legislation and Guidance

The following legislation and guidance will be considered and followed (where applicable):

- The IEMA guidance document 'Major Accidents and Disasters in EIA: A Primer'[130];
- The Health and Safety at Work etc. Act 1974 (HSWA)[131];
- The Construction (Design and Management) (CDM) Regulations 2015[132];
- Chemicals and Downstream Oil Industries Forum Guidelines, Environmental Risk Tolerability for COMAH Establishments[133];

[128] HM Government (1995) *Boreholes Safety and Operations Regulations*. Available online: https://www.legislation.gov.uk/uksi/1995/2038/contents/made
[129] The offshore installations and wells (design and construction etc) regulations 1996. Available online: The offshore installations and wells (design and construction etc.) regulations 1996 - SPC/Enforcement/170 (hse.gov.uk)
[130] The Institute of Environmental Management and Assessment (2020) *Major Accidents and Disasters in EIA: A Primer.* Available online: https://www.iema.net/resources/reading-room/2020/09/28/major-accidents-and-disasters-in-eia-an-iema-primer
[131] UK Legislation (1974) *Health and Safety at Work etc. Act*. Available online: https://www.legislation.gov.uk/ukpga/1974/37/contents
[132] UK Legislation (2015) The Construction (Design and Management) Regulations. Available online: https://www.legislation.gov.uk/uksi/2015/51/contents/made
[133] Chemical and Downstream Oil Industries Forum (2013) Guidelines Environmental Risk Tolerability for COMAH Establishments. Available online: https://www.sepa.org.uk/media/219154/cdoif_guideline__environmental_risk_assessment_v2.pdf

- Guidelines for Environmental Risk Assessment and Management (DEFRA, 2011)[134];
- HAZOP and HAZAN: Identifying and Assessing Process Industry Hazards, 1992[135];
- Process Plants – a Handbook for Inherently Safer Design, 2006[136];
- ISO 31000:2009 Risk Management principles and guidelines (The International Standards Organization, 2009)[137];
- Reducing Risks, Protecting People: HSE's decision making process, (HSE, 1999)[138].

17.3 Baseline Conditions

17.3.1 Data Sources used in Scoping

The following baseline environmental characteristics of the study area have been assessed as part of the wider EIA:

- potential natural hazards which may affect the Proposed Development including meteorological hazards, geological hazards, and other types of hazards.
- existing major accident hazard (MAH) sources that may affect the Proposed Development; and
- sensitive environmental receptors within the study area at risk of Major Accidents and Disaster (MA&D) hazards associated with the Proposed Development.

17.3.2 Description

The MA&D Assessment will consider all MAHs with potential to cause significant adverse effects on safety and the environment, from the proposed facilities and from 'domino effects' from adjacent sites.

17.3.3 Key Sensitivities

Receptors to be considered in the assessment include:

- population and human heath including public and local communities.
- biodiversity.
- land, soil, water, air, and climate; and
- property and material assets, cultural heritage, and the landscape.

The key sensitivities in terms of human, ecological, cultural heritage and other assets are identified and described in the relevant topic sections.

17.4 Project Basis for Scoping Assessment

The following key infrastructure will be included in the MA&D assessment in the EIA:

- underground hydrogen storage.
- processing facilities (OCGT);
- wellhead and associated facilities; and
- hydrogen / oxygen venting (or flaring);

[134] Department for Environment, Food and Rural Affairs (2011) Guidelines for environmental risk assessment and management: Green leaves III. Available online: https://www.gov.uk/government/publications/guidelines-for-environmental-risk-assessment-and-management-green-leaves-iii

[135] Trevor A. Kletz (1992) Hazop and Hazan: Identifying and Assessing Process Industry Hazards

[136] Trevor A. Kletz, Paul Amyotte (2010) Process Plants: A Handbook for Inherently Safer Design, Second Edition

[137] ISO Standards (2009) Risk management — Principles and guidelines

[138] The Health and Safety Executive (1999) Reducing Risks: Protecting People; HSE's decision-making process

17.5 Mitigation

The objective of the MA&D assessment is to demonstrate the vulnerability of the Proposed Development to risks of major accidents and/or disasters which are relevant have been considered. Where appropriate, the assessment will include measures that are envisaged to prevent or mitigate the significant adverse effects of major accidents and/or disasters on people and the environment, together with details of the proposed preparedness and response measures.

Through the application of engineering good practice and mitigation measures included in design, it is anticipated that MAH risks associated with the Proposed Development will be adequately managed.

17.6 Likely Significant Effects to be considered in the EIA

The MA&D Assessment will cover all aspects of the Proposed Development that could have potential significant adverse effects on people and the environment.

At this stage, the scoping exercise has not sought to identify likely significant effects. To do so requires a combination of sufficient design information and working alongside the design team on hazard identification. These activities will be carried out in future stages of the EIA.

On the basis of present understanding of the Proposed Development, the following primary hazard categories to be considered as part of the MA&D Assessment are anticipated to be:

- loss of containment of hazardous substances such as hydrogen leading to fire / explosion.
- domino effects to / from adjacent industrial sites.
- extreme weather;
- lightning.
- seismic activity.
- subsidence / erosion.
- flooding.
- fire;
- structural / building collapse.
- security.

17.7 Effects Scoped out of the EIA

The MA&D Assessment will cover the construction and operation phases of the Proposed Development. However, only significant adverse safety or environmental effects will be considered. For example, typical health and safety hazards associated with construction will not be included in the assessment (although those related to traffic, airborne dust and contaminated land will be addressed by other EIA topics).

17.8 Proposed Approach to the Assessment

Hazard Identification studies will be carried out during the early design stage for all aspects of the Proposed Development where there is potential for a major accident to people or to the environment. The objective of these studies will be to identify major accident hazards, assess risk levels and define preventative and mitigative control measures. The studies will cover the construction and drilling phases to the extent necessary but will focus on operation of the Proposed Development. Further detailed hazard and risk assessment studies will be required and undertaken at later design stages.

17.8.1 Specific Methodologies

The MA&D Assessment will be carried out using a Hazard Identification (HAZID) study methodology which includes identification of sources / pathways / receptors, an assessment of the worst-case credible safety and environmental consequences and documenting of the planned measures to prevent or mitigate the undesirable events.

The following section describes the key steps in the HAZID study process.

Step 1: Select Hazard Category and Guideword

- Select a hazard category and guideword from a checklist, which will be developed in accordance with industry standards, to ensure all potential hazards are identified.

Step 2: Identify Sources, Pathways and Receptors

- For each hazard category and guideword, all potential sources (i.e., cause of the hazard) with potential to cause significant harm will be identified. Pathways (i.e., the route by which the source can reach the receptor) and receptors (i.e. specific component of the environment that could be adversely affected) will be assessed.
- At this stage, screening will be carried out to assess whether the source and pathway could result in a hazard which was deemed significant and therefore whether it will be assessed further as part of the MA&D Assessment.
- The process of identifying MA&D hazards will include a review of previous incidents and will be based on the experience of technical safety consultants with experience in each of the sectors relevant to the Proposed Development.

Step 3: Develop Consequences

- The ‘worst case credible’ consequences of the undesirable event will then be evaluated and recorded. The unmitigated consequences (without giving credit to mitigations) will be documented.
- The assessment will apply Rochdale Envelope principles, which involves assessment of the reasonable worst-case credible MA&D risks and consequences associated with the Proposed Development. This conservative methodology establishes the worst-case scenarios, the risk of which should be reduced to a level that is ALARP during the detailed design, construction planning and operation of the Proposed Development.
- The HAZID study will utilise the output of hazard and risk assessments carried out during the Pre-FEED stage including consequence modelling.

Step 4: Risk Rank without Mitigations

- Risk ranking will be carried out by combining the severity and estimated likelihood using a risk matrix. The risk ranking will initially be carried out without safeguards to assess the unmitigated risk.

Step 5: Identify Mitigations

- Mitigations will be documented for the identified sources and consequences. At the MA&D assessment stage of the Proposed Development, safety and control systems will not have been fully designed. However, good practice industry approaches to managing risk will be used. In addition, equipment such as process monitoring, safeguarding systems and embedded mitigation will be provided as required.

Step 6: Risk Rank with Mitigations

- Risk ranking will be carried out with mitigation in place to determine the mitigated risk.

Step 7: Define Specific Requirements to Achieve Mitigations

- Where the HAZID team identify a requirement that would need to be developed into a mitigation in the subsequent phases of the Proposed Development, these will be documented.

17.8.2 Assessment Criteria

The following factors will be considered in determining whether potential adverse effects are 'significant':

- The geographic extent of the effects: effects beyond the Proposed Development boundaries are more likely to be considered significant.
- The duration of the effects: effects which are permanent (i.e. irreversible) or long lasting are more likely to be considered significant.
- The severity of the effects in terms of number, degree of harm to those affected and the response effort required: effects which trigger the mobilisation of substantial civil emergency response effort are likely to be considered significant.
- The sensitivity of the identified receptors: significant effects are more likely to result for receptors that are less able to avoid, adapt to or tolerate an impact.
- The effort required to restore the affected environment: effects requiring substantial clean-up or restoration efforts are likely to be considered significant.

The assessment will use the risk matrix in **Table 17-2** to categorise threats and hazards, based on severity of the consequence and likelihood.

Severity of the consequence of a hazard or threat will be determined on the basis of a reasonably foreseeable worst-case safety and environmental effects of the event. The likelihood of the hazard or threat occurring will be determined based on the likelihood of the cause, taking into account the source-pathway-receptor linkage.

The combination of severity and likelihood will provide an estimate of the risk. The risk is estimated first without proposed embedded mitigation. The risk is then estimated with proposed embedded mitigation in place.

The risk is categorised using the matrix in terms of 'Green - Low risk', 'Yellow - Medium risk', 'Orange - High Risk', 'Red - Extreme Risk'. These are to be aligned with the ALARP principle as follows:

- Risks categorised as 'Low risk' are assumed to be 'broadly acceptable'.
- Risks categorised as 'Medium' or 'High' (when including mitigations) would generally sit within the 'tolerable if ALARP' region and require a more detailed review of mitigations in order to demonstrate that the risk is ALARP.
- Risks categorised as 'Extreme' (when including mitigations) are generally considered as 'intolerable' and require further mitigations in order to reduce the risk to ALARP.

Risks categorised as 'broadly acceptable' and 'tolerable if ALARP' (with mitigation in place) are not considered to have significant environmental effects; a risk categorised as extreme (with mitigation in place) would have a significant environmental effect. This is as shown in **Table 17-1** below.

Table 17-1 Risk Categorisation

1 - LOW RISK	**Acceptable**	**Environmental effect - Not significant**
2 - Medium Risk	Tolerable if ALARP	Environmental effect - Not significant
3 - High Risk	Tolerable if ALARP	Environmental effect - Not significant
4 - Extreme Risk	Unacceptable	Environmental effect - Significant

It is noted that the MA&D assessment will not constitute a formal ALARP demonstration and any inferred alignment between the ALARP regions and the levels of risk claimed is purely indicative, due to the early stage of the design.

Table 17-2 MA&D Assessment Risk Matrix

SEVERITY	Consequences				Increasing Likelihood				
	Safety (S)	**Environmental (E)**	**Financial (F)**	**Reputation (R)**	**A**	**B**	**C**	**D**	**E**
					Never heard of in the industry	Heard of in the industry	Has happened in the Organisation or more than once per year in the industry	Has happened at the Location or more than once per year in the Organisation	Has happened more than once per year at the location
0	No injury or health effect	No effect	No damage	No impact	1 - Low Risk	1 - Low Risk	1 - Low Risk	1 - Low Risk	1 - Low Risk
1	Slight injury or health effect	Slight effect	Slight damage	Slight impact	1 - Low Risk	1 - Low Risk	2 - Medium Risk	2 - Medium Risk	2 - Medium Risk
2	Minor injury or health effect	Minor effect	Minor damage	Minor impact	1 - Low Risk	2 - Medium Risk	2 - Medium Risk	3 - High Risk	3 - High Risk
3	Major injury or health effect	Moderate effect	Moderate damage	Moderate impact	2 - Medium Risk	2 - Medium Risk	3 - High Risk	3 - High Risk	4 - Extreme Risk
4	Permanent Total Disability (PTD) or up to 3 fatalities	Major effect	Major damage	Major impact	2 - Medium Risk	3 - High Risk	3 - High Risk	4 - Extreme Risk	4 - Extreme Risk
5	More than 3 fatalities	Massive effect	Massive damage	Massive impact	3 - High Risk	3 - High Risk	4 - Extreme Risk	4 - Extreme Risk	4 - Extreme Risk

18. WASTE MANAGEMENT

18.1 Introduction

This section of the report considers the potential effects of the Proposed Development with respect to waste generation and management. This section includes: the policy context for waste generation, reduction, management, and disposal; a baseline overview; potential effects and mitigation; and the assessment methodology and criteria.

The assessment will especially focus on the potential for waste generated in the construction and operational phases of the Proposed Development to present risks to receptors, as well as the risk of exceeding the planned landfill capacity in the Yorkshire and Humber Region during the lifecycle of the Proposed Development.

18.2 Topic-specific Regulatory Requirements and Guidance

18.2.1 Control of Pollution (Amendment) Act 1989

The Control of Pollution (Amendment) Act 1989[139] aims to "*Provide for the registration of carriers of controlled waste and to make further provision with respect to the powers exercisable in relation to vehicles shown to have been used for illegal waste disposal*".

It is an offence for anyone who is not a registered carrier of controlled waste to transport any controlled waste to or from a place in Great Britain whether for profit or for business.

18.2.2 Waste (England and Wales) Regulations (2011)

The Waste (England and Wales) Regulations 2011[140] came into force on 29 March 2011. The regulations update aspects of waste controls and emphasise the need for waste permits and authorisations for certain activities.

The regulations aim to protect the environment and human health by preventing or reducing the generation of waste, reducing the adverse impacts of the generation and management of waste, and reducing the overall impacts of resource use.

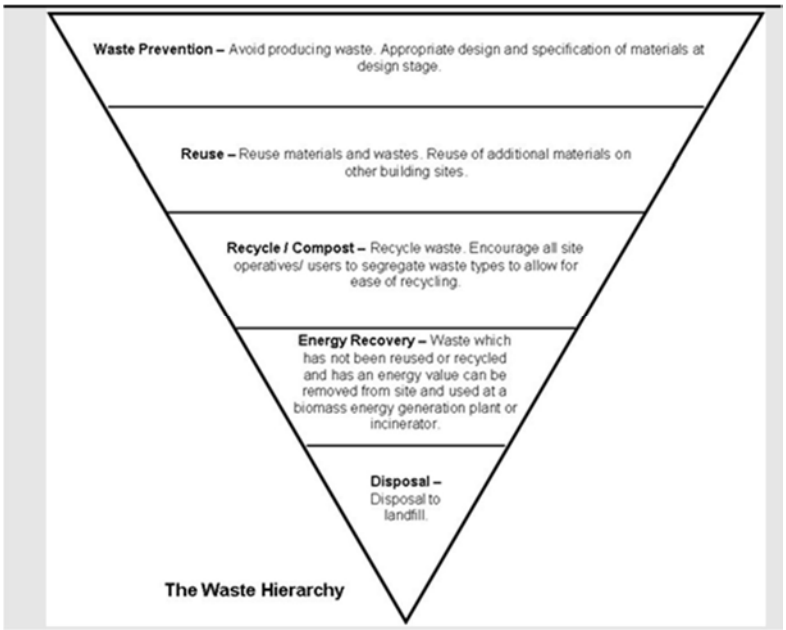
The regulations implement the revised Waste Framework Directive under the Duty of Care Regulations 1991, and require business to confirm that they have:

- applied the waste management hierarchy when transferring waste and to include a declaration on their waste transfer note or consignment note;
- require a new permit waste hierarchy permit condition and where appropriate a condition relating to the mixing of hazardous waste.
- introduce a two-tier system for waste carrier and broker registration, which includes those who carry their own waste, and introduces a new concept of a waste dealer.
- make amendments to hazardous waste controls and definition; and
- exclude some categories of waste from waste controls, notably animal by-products whilst include a small number of radioactive waste materials.

The Waste Regulations (2011) also set out the principles for putting into place the Waste Hierarchy, seeking to establish practice to reduce the volume of waste sent to landfill.

[139] UK Government (1989) *Control of Pollution (Amended) Act 1989.* Available online: https://www.legislation.gov.uk/ukpga/1989/14/contents
[140] UK Government (2011) *The Waste (England and Wales) Regulations 2011*. Available online: https://www.legislation.gov.uk/uksi/2011/988/contents/made

Figure 18-1 The Waste Hierarchy



18.2.3 Waste (England and Wales) (Amendment) Regulations 2014

These regulations amend the Waste (England and Wales) Regulations 2011[141], adding in regulation 29, a list of offences for the purposes of refusing registration of carriers, brokers and dealers of controlled waste. This amendment also added a new part (Part 10A) relating to the production of authority for transporting controlled waste, specifying how an authority to transport waste must be presented.

18.2.4 Controlled Waste (England and Wales) Regulations 2012

Under these regulations[142], waste from construction or demolition works, including preparatory works are to be classified as 'Industrial', and treated as household waste for the purposes of Section 34(2) and (2A) of the Act only.

18.2.5 The Hazardous Waste (England and Wales) Regulations 2005

These regulations[143] set out the regime for the control and tracking of hazardous waste in England and Wales. Under these regulations, a process of the registration of hazardous waste producers and a new system for recording the movement of hazardous waste was introduced.

All industrial and commercial premises producing more than 500 kg of hazardous waste have to notify their existence to the Environment Agency. Additional requirements include the following.

- No hazardous waste can be collected from any unregistered site.
- Waste producers who do not register their premises will be committing and offence.

[141] UK Government (2014) *The Waste (England and Wales) (Amended) Regulations 2014.* Available online: https://www.legislation.gov.uk/uksi/2014/656/contents/made
[142] UK Government (2014) *The Controlled Waste (England and Wales) Regulations 2012*. Available online: https://www.legislation.gov.uk/uksi/2012/811/contents
[143] UK Government (2005) *The Hazardous Waste (England and Wales) Regulations 2005*. Available online: https://www.legislation.gov.uk/uksi/2005/894/contents/made

- Waste contractors who move waste from a non-registered site will be committing an offence.
- Waste producers will need to provide proof to waste contractors (via a unique code) that they are registered.

Under the Regulations, the movement of wastes is controlled by a documentation system which has to be completed whenever waste is removed from premises. From the waste producer's perspective, a Consignment Note must be produced and completed before waste can be removed and the following information must be provided:

- a description of the waste.
- the process giving rise to the waste.
- the quantity of waste.
- the chemical (and/or biological) components and their concentrations.
- the hazard codes, the List of Waste (LoW) code.
- the container types.
- where the information is being received.
- the consignment notes with a unique number; and
- waste producers will need to provide proof to waste contractors (via a unique code) that they are registered.

18.2.6 Waste Management Plan for England 2021

The Waste Management Plan for England[144] fulfils the requirements of the Waste (England and Wales) Regulations 2011 (as amended) for the waste management plan to be reviewed every six years. It provides an analysis of the current waste management situation in England and evaluates how it will support the implementation of the objectives and provisions of the Waste (England and Wales) Regulations 2011 (as amended). The Plan also provides an overview of the type, quantity and source of waste generated within England; existing waste collection schemes and major disposal and recovery installations; an assessment of the need for new collection schemes; and general waste management policies.

The 2021 Plan supersedes the previous waste management plan for England and includes changes to waste management plan requirements which have been made by the Waste (Circular Economy) (Amendment) Regulations 2020 where appropriate.

The Definition of Waste: Development Industry Code of Practice (DoW: CoP)

This CoP serves the following purposes:

- It sets out good practice for the development industry to use when:
- Assessing on a site-specific basis whether excavated materials are classified as waste or not; and
- Determining on a site-specific basis when treated excavated waste can cease to be waste for a particular use.
- It describes an auditable system to demonstrate that this CoP has been adhered to.

The Environment Agency will take account of this CoP in deciding whether to regulate the materials as waste. If materials are dealt with in accordance with the CoP the EA considers that those materials are unlikely to be waste if they are used for the purpose of land development. This may be because

[144] DEFRA (2021) *Waste Management Plan for England*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/955897/waste-management-plan-for-england-2021.pdf

the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

18.3 Baseline Environment

18.3.1 Data Sources used in Scoping

Existing baseline capacity, and information on the annual volume and nature of wastes received by landfills in Yorkshire and The Humber planning region were sourced from the Environment Agency Waste Management Interrogator[145] (accessed November 2022). In addition, the Joint Waste Local Plan for Kingston upon Hull and the East Riding of Yorkshire (adopted November 2004) was reviewed to identify local authority waste sites.

A desktop review will be undertaken during the EIA once the waste aspects of the Proposed Development are better understood and in advance of issuing the ES to provide determine the distance and capacity of registered landfill facilities local to the Proposed Development.

18.3.2 Description

The following sections outline the baseline conditions in relation to the projected total volume and the existing volume of waste materials received by registered landfills within Yorkshire and The Humber Region. This information will provide a baseline against which the effects of construction, operation and decommissioning of the Proposed Development on the available landfill capacity and the volume of waste delivered to receiving landfills annually can be assessed.

18.3.3 Existing Landfill Capacity and Inputs

Baseline conditions with respect to the available landfill capacity within Yorkshire and The Humber regions are reviewed in this section.

The number of operational landfill facilities in Yorkshire and The Humber Region as of 2021 is shown in **Table 18-1.**

Table 18-1 Operational landfill facilities within Yorkshire and The Humber Region (Source: EA Waste Interrogator 2021)

Sub Region	East Riding of Yorkshire	North Yorkshire	South Yorkshire	West Yorkshire
Number of operational facilities	6	7	7	15

Within the East Riding of Yorkshire district, there are six registered landfill facilities, as shown in **Table 18-2**.

[145] Environment Agency (2021) *2021 Waste Data Interrogator*. Available online: https://www.data.gov.uk/dataset/d8a12b93-03ef-4fbf-9a43-1ca7a054479c/2021-waste-data-interrogator

Table 18-2 Registered Landfill Facilities within East Riding of Yorkshire in 2021 (Source: EA Remaining Landfill Capacity[146])

Facility Address	EA Area	Former Planning Region	Former Planning Sub-Region	Local Authority	Site Type
Swinescaife Quarry, South Cave, Brough, North Humberside, HU15 2BE	Yorkshire	Yorkshire and Humber	East Riding of Yorkshire	Former Humberside	L05 – Inert Landfill
Wilberfoss Quarry Landfill, Rear Of Newton Lodge Farm, Newton-on-Derwent, York, North Yorkshire, YO41 4DB	Yorkshire	Yorkshire and Humber	East Riding of Yorkshire	Former Humberside	L05 – Inert Landfill
Milegate Extension Landfill Site, Catwick Lane, Driffield, YO25 8SA	Yorkshire	Yorkshire and Humber	East Riding of Yorkshire	Former Humberside	L04 – Non Hazardous
Riplingham Cutting Landfill, Riplingham HU20 3UP	Yorkshire	Yorkshire and Humber	East Riding of Yorkshire	Former Humberside	L05 – Inert Landfill
Moor Lane, Carnaby YO16 4UU	Yorkshire	Yorkshire and Humber	East Riding of Yorkshire	Former Humberside	L04 – Non-Hazardous
Market Weighton Road, Holme-on-Spalding Moor YO43 4ED	Yorkshire	Yorkshire and Humber	East Riding of Yorkshire	Former Humberside	L02 – Non-Hazardous Landfill With Stable Non Reactive Hazardous cell

The total remaining landfill capacity for the East Riding of Yorkshire and the total volume for the Yorkshire and The Humber region is shown in **Table 18-3**.

Table 18-3 Remaining Landfill Capacity for East Riding and Yorkshire and the Humber in 2021 (Source: EA Waste Interrogator 2021)

Local Authority	Hazardous	Inert	Non-Hazardous (with SNRHW cell)	Non-Hazardous	Restricted
East Riding of Yorkshire	-	15,372,000	1,243,000 m^3	20,610,000 m^3	-
TOTAL (Yorkshire and The Humber)	1,465,000 m^3	25,282,000 m^3	1,243,000 m^3	45,196,000 m^3	-

18.3.4 Key Sensitivities

Registered landfill sites used by the Proposed Development may be affected by construction, operational and decommissioning works through a material increase in the volume of waste types received. This is most likely to occur during the construction and decommissioning phase of the Proposed Development, where projected waste volumes are expected to be the highest.

[146] Environment Agency (2021) *2021 Remaining Landfill Capacity.* Available online: https://environment.data.gov.uk/portalstg/home/item.html?id=b8236bc4b739408eada95f8528de9ff8

Residential receptors on the routes from the Proposed Development to the landfill facilities used may be affected by an increase in traffic; this will be assessed as part of Traffic and Transport (see section 11). Additional consideration will be given to receptors which may be affected by the agreed haul route.

At the point of generation, handling and storage of waste may affect soils, surface and groundwater receptors on land used by the Proposed Development during construction and operation. Potential effects on soils and water resources are addressed in section 7 (Geology and Ground Conditions) and section 8 (Water Resources and Flood Risk).

18.4 Project Basis for Scoping Assessment

18.4.1 Construction Phase

The greatest potential for impacts regarding waste management will be during the construction phases from activities that mainly include:

- site preparation (including possible demolition of existing structures, depending on the selected location within the Site for the new infrastructure), levelling and possible generation of surplus soil and subsoil that need to be removed from the site.
- excavations (for foundations) and piling; and
- potential encounters with contaminated materials.

18.4.2 Operational Phase

Wastes arising during operation will be significantly less in volume than those during construction but may include materials that require specialist treatment and disposal.

18.4.3 Decommissioning

Decommissioning will take place after an anticipated 25 years of operation and will consider the legal requirements at the time and be undertaken in accordance with a decommissioning plan approved by the relevant regulatory authority. It is anticipated that application of the waste management hierarchy will be at the core of a future decommissioning plan.

18.5 Mitigation

Mitigation measures that will be adopted with respect to waste generation and handling will largely comprise standard industry practice focused on the principles for implementing the Waste Hierarchy, seeking to minimise the volume of waste sent to landfill.

During the construction phase of the Proposed Development, the contractor will be required to develop and implement a construction phase Waste Management Plan (WMP). The WMP will be developed in detail by the appointed contractor(s) and outline documents will be included in the ES. These will include reference to guidance provided by The Waste and Resources Action Programme (which operates as WRAP), in the re-use of materials and promoting the circular economy.

The disposal of waste, including any surplus spoil, will be managed so far as is reasonably practicable to maximise the environmental and development benefits from the use of surplus material and reduce any adverse environmental effects of disposal in accordance with the relevant waste management regulations e.g., The Environmental Permitting (England and Wales) Regulations 2016 [147]. The DoW;CoP will be employed to promote the re-use and repurposing of soils wherever possible.

[147] UK Government (2016) *The Environmental Permitting (England and Wales) Regulations 2016*. Available online: https://www.legislation.gov.uk/uksi/2016/1154/contents/made

Should any contamination be encountered which requires removal, all contaminated materials will be characterised both chemically and physically in line with BS EN 14899:2005 'Characterization of Waste - Sampling of Waste Materials'[148] to classify the waste and ensure correct disposal.

With regards to the temporary storage of waste materials on site during construction, designated, bunded and appropriately surfaced areas will be constructed to manage the risks of migration of contaminants to receptors in line with industry standards, as will be set out in the Construction WMP.

18.6 Likely Significant Effects to be considered in the EIA

Table 18-4 below is a tool aimed at delivering a proportionate approach to the EIA. In doing so it sets out a high-level assessment of all potential effects, significant or not, where appropriate noting actions, including baseline data acquisition, for significant effects scoped in. The basis for scoping out certain effects is presented after the table.

As decommissioning will be approximately 25 years in the future, it will not be addressed at the same level of detail as the other phases (i.e. construction and operational) and in general it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

Table 18-4 Likely Effects – Waste Management

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Handling and disposal of excess soils placing significant burden on Yorkshire and The Humber Region landfill capacity	Principles set out in the Waste Hierarchy	Minor	Scoped In	Options to re-use excess soils under the DoWCoP. Update and confirm landfill capacities in the ES.
Handling and disposal of construction wastes placing significant burden on Yorkshire and The Humber Region landfill capacity	Principles set out in the Waste Hierarchy	Not significant	Scoped In	Segregation of different waste streams and options to re-use and recycle in line with WRAP guidance. Update and confirm landfill capacities in the ES.
Handling and disposal of operational wastes placing significant burden on Yorkshire and The Humber Region landfill capacity	Principles set out in the Waste Hierarchy	Not significant	Scoped In	Segregation of different waste streams and use of licenced waste management companies to implement options to re-use and recycle in line with WRAP guidance. Update and confirm landfill capacities in the ES.
Handling and disposal of waste generated by decommissioning placing significant burden on Yorkshire and	Principles set out in the Waste Hierarchy	Minor	Scoped out	N/A

[148] European Standards (2016) *BS EN 14899:2005*. Available online: https://www.en-standard.eu/bs-en-14899-2005-characterization-of-waste-sampling-of-waste-materials-framework-for-the-preparation-and-application-of-a-sampling-plan/#:~:text=This%20European%20Standard%20specifies%20the,objective%20of%20the%20testing%20programme

Proposed Development Activity and Impact	Embedded Mitigation Measures	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
The Humber Region landfill capacity				

18.7 Effects Scoped Out of the EIA

While an effect may be proposed to be scoped out, the ES will still provide baseline information on the receptor(s) concerned and set out any relevant measures the Proposed Development will adopt to mitigate impacts on the receptor(s).

Assessing the effects on landfill capacity for the decommissioning phase is scoped out. This phase is unlikely to generate large volumes of inert material (e.g. soils) and the majority of surface equipment will be dealt with in accordance with the waste hierarchy, with a significant proportion (metallic materials, electrical cables etc.) amenable to recycling. In general, it is assumed that the environmental effects from decommissioning will be no worse than those that occur during construction.

The potential effects (and their mitigation) of solid wastes handling and storage in working areas and on the operational Proposed Development site will be assessed in section 7 Geology and Ground Conditions and section 8 Water Resources and Flood Risk and will not be included in the scope of the waste assessment.

18.8 Proposed Approach to the Assessment

18.8.1 Proposed Development Waste Generation

Waste will be generated during construction, with the majority of this potentially as surplus site preparation and excavation material. Other construction waste types will be generated in smaller quantities, with the majority of this waste expected to be recycled by the construction contractor as will be set out in a construction WMP. The remainder of the waste will be disposed of offsite by a licensed waste management contractor to be appointed by the construction contractor. If alternative options can be established using the DoW: CoP, these will be pursued in preference to landfilling.

Estimates of the volume and composition of waste generated at the Proposed Development will be established for the assessment using benchmark waste data. Estimated waste composition data will be derived from new build industrial buildings published by WRAP (WRAP, 2009) for the Proposed Development. Total provisional construction waste volumes will be estimated using Smartwaste Waste Benchmark Data based on the development footprints for the various elements of the Proposed Development.

The assessment will consider a worst case, assuming it is not possible to retain or reuse any excavated materials on site, and therefore it will require offsite disposal.

Operational waste will largely be made up of standard industrial site operational wastes which will be managed in accordance with relevant environmental regulations. Waste from maintenance activities is expected to be significantly lower than from operation and will therefore not be considered separately in the assessment.

18.8.2 Assessing Effects on Landfill Capacity

The effects of waste generated during construction at the AHP project site will be assessed by:

- establishing the baseline for landfill capacity in the East Riding and Humberside planning region for inert, non-hazardous, stable non-reactive hazardous, and hazardous waste types.

- estimating the likely quantity of surplus excavation material and construction-derived waste likely to be generated at the Proposed Development site, and the approximate percentages of these materials classified as the relevant waste types (assuming a worst-case scenario); and
- comparing the quantity of surplus excavated materials and construction-derived waste from the Proposed Development to the baseline landfill capacity and assessing the effect on the capacity and ability of landfill sites to accept the waste.
- In order to assess the significance of the Proposed Development on the baseline landfill capacity, the following significance criteria have been applied in line with those used previously for Waste ES in Yorkshire and The Humber Planning Region (EP Waste Management Limited, 2020[149]).

Table 18-5 Evaluation on the significance of the Project Site or Landfill Capacity

Effect	Criteria for Effects of Waste Generated (Construction)	Criteria for Effects of Waste Generated (Operation)	Significance
Negligible	Increase in waste arisings less than 0.1% of the current disposal capacity. Insignificant burden to the local and regional waste management infrastructure.	Increase in waste arisings of less than 0.1 % of the current annual waste arisings for the region.	Not significant
Minor	Increase in waste arisings between 0.1% and 1.9% of current available disposal capacity, causing minor burden to the local and regional waste management infrastructure.	Increase in waste arisings between 0.1% and 1.9% of current annual waste arisings for the region.	Not significant
Moderate	Increase in waste arisings between 2% and 5% of current available disposal capacity, causing moderate burden to the local and regional waste management infrastructure.	Increase in waste arisings between 2% and 5% of current annual waste arisings for the region.	Significant
Major	Increase in waste arisings greater than 5% of current available disposal capacity, causing significant burden to the local and regional waste management infrastructure.	Increase in waste arisings greater than 5% of current annual waste arisings for the region.	Significant

[149] EP Waste Management Ltd. (2020) *Document Ref. 6.2 Environmental Statement: Volume I*. Available online: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010107/EN010107-000176-SHBEC%20DCO%20-%206.2.16%20ES%20Vol%20I%20Chapter%2016%20Waste%20Management.pdf

19. CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS

19.1 Introduction

This assessment will consider the potential impacts of the operation (including maintenance) of the Proposed Development in terms of climate change and greenhouse gas (GHG) emissions; construction and decommissioning impacts will be addressed to the extent applicable. This assessment will also consider the potential impact of projected future climate change on the Proposed Development and surrounding environment.

GHG emissions are separated into three categories for assessment purposes. These are:

- Scope 1: direct emissions, for example emissions from the OCGT
- Scope 2: indirect emissions, for example emissions associated with electricity purchased from the national grid
- Scope 3: indirect emissions that occur in within the project's value chain

The assessment will not include Scope 3 emissions.

19.2 Topic specific Regulatory Requirements and Guidance

Relevant to climate change, the EIA Regulations state that the EIA must "*identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on...climate*" and other factors specified.

Where relevant to the specific characteristics of a particular development or type of development and to the environmental features likely to be significantly affected, the ES is to include "*a description of the factors... likely to be significantly affected by the development…climate (for example greenhouse gas emissions, impacts relevant to adaptation)*" and "*a description of the likely significant effects of the development on the environment resulting from...the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change*".

The UK Climate Change Act (2008) sets targets related to GHG emissions and establishes that a UK-wide Climate Change Risk Assessments for carbon budgets must be undertaken every five years.

In June 2021 the UK government set into law the Sixth Carbon Budget to reduce GHG emissions by 78% of 1990 levels by 2035 and for the UK to be net-zero by 2050. The strategy and policies proposed to by the UK government to achieve this are outlined in the Net Zero Strategy[150].

The principles of the National Planning Policy Framework relevant to climate change are provided in Section 14 'Meeting the challenge of climate change, flooding and coastal change', which states: "*the planning system should support the transitions to a low carbon future in a changing climate… It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure*".

Key guidance on assessing greenhouse gas emissions is provided in Environmental Impact Assessment Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance developed by IEMA[151].

[150] Department for Business, Energy and Industrial Strategy (2021) *Net Zero Strategy: Build Back Greener*. Available online: https://www.gov.uk/government/publications/net-zero-strategy#:~:text=This%20strategy%20sets%20out%20policies,net%20zero%20target%20by%202050.
[151] IEMA (2017) *Assessing Greenhouse Gas Emissions and Evaluating their Significance.* Available at: https://www.iema.net/preview-document/assessing-greenhouse-gas-emissions-and-evaluating-their-significance

19.3 Baseline Conditions

19.3.1 Data Sources used in Scoping

There are no direct baseline GHG emissions data from the Proposed Development site to review, as GHG emissions prior to the Project are considered to be zero.

Reference sources, including the State of the UK Climate 2020[152] report will be used to define the current status of the UK environment. Other data that will be required to inform the assessment includes:

- vessel and vehicle activity data;
- site equipment electrical load lists;
- site production rates, capacity and utilisation.
- venting rates and frequencies.
- physical and transition input.
- legislation and planning policy context

The quality of the assessment will be dependent on the quality of the GHG data and the timeliness with which it is provided.

19.3.2 Description

The IEMA guidance states the GHG assessment should consider:

- a baseline which considers current GHG emissions from the physical boundary; and
- alternative baseline / counterfactual associated with future operational emissions.

As noted above there are no direct baseline GHG emissions from the Proposed Development site.

The alternative baseline conditions for the climate change assessment, specifically, a GHG impact assessment, will be a business-as-usual scenario whereby the Proposed Development does not proceed.

The State of the UK Climate 2020 provides a comprehensive summary of how the climate and weather is changing in the UK due to global warming, where on average the weather is becoming warmer and wetter with more extremes. Some key climate trends include the following:

- The decade 2011 - 2020 was on average 0.5°C warmer than the 1981-2010 average;
- The average mean sea level has risen by approximately 1.5 mm/year^{-1} compared to the start of the 20th century, which has resulted in a rise of 16.5 cm during this period;
- The decade 2011 - 2020 was 4% wetter on average than that of 1981-2010 and 9% wetter than the period 1961-1990;
- In general, the wind trends have remained fairly stable with no significant trends being noted over the last 5 decades; and
- In 2020, the average mean sea surface temperature for near coast waters was 0.5°C higher than for the period 1981-2010.

The coastline local to the Proposed Development is eroding at up to 4 m per year. As the effects of climate change progress, including enhanced sea level rise and increasing frequency and severity of storms, the rate of coastal erosion has the potential to increase.

[152] State of the UK Climate 2020, International Journal of Climatology

19.3.3 Key Sensitivities

GHG emissions have a global and cumulative impact on global warming and climate change. GHG emissions have the same worldwide effect wherever and whenever they occur, hence the receptor is the entire atmosphere. There are therefore no localised sensitive receptors as such due since the effects of greenhouse gases on climate change are a global concern.

The main concern relating to the Proposed Development is its contribution of greenhouse gases to global climate change and alignment with UK Government policy around greenhouse gas emissions and achieving 'net zero'.

Other key sensitivities relate to flood risk and coastal change as addressed elsewhere in this report.

19.4 Project Basis for Scoping Assessment

The key aspects of the Proposed Development that will generate GHG emissions are likely to be:

- fuel consumption of construction and installation equipment and vessels (including brine tankers);
- operation of the water abstraction / discharge pumps;
- operation of the OCGT when using natural gas or a natural gas blend with hydrogen;
- alternative brine discharge through tankering offsite with disposal at the nearby licenced SSE Atwick site or alternative disposal site;
- fuel consumption of maintenance equipment, vehicles and vessels;
- fuel consumption of vehicles and vessels during the decommissioning phase; and
- vented and fugitive hydrogen, due to its indirect global warming potential.

19.4.1 Scope 1 Emissions

To support estimation of construction phase GHG emissions, the assessment will consider the following:

- construction and installation vessel and vehicle activity data (time in operation on station and/or distance travelled);
- Any vessel and vehicle fuel consumption data;
- vessel and vehicle fuel type and composition;
- equipment and machinery activity data, fuel consumption and composition (if relevant); and
- water abstraction / discharge pump activity data, fuel consumption and composition (if relevant).

The operational maintenance plan, detailing planned inspection and maintenance frequencies and durations will be reviewed to support calculation of GHG emissions from company vehicles. The availability target for the facility will be used to support this evaluation.

In order to support estimation of the decommissioning phase GHG emissions, the assessment will consider similar outputs to those used to estimate construction phase emissions.

19.4.2 Scope 2 Emissions

In order to estimate the Scope 2 emissions during the construction phase, activity and electrical consumption data for any electric-powered equipment will be required. If brine tankering is carried out by diesel fuelled vehicles there will be no additional scope 2 emissions attributable to the brine tankering operations.

During the decommissioning phase activity and electrical consumption data for any electric-powered equipment will be considered.

The Scope 2 electricity GHG impact will be based on UK national emission factors unless the project team can provide information on any market-based tariff to be used.

19.4.3 Avoided Emissions

To provide additional context to the estimated GHG emissions footprint, predicted avoided emissions due to operation of the OCGT using natural gas blended with or operating entirely with hydrogen compared to operation with 100% natural gas will also be estimated. This will use UK Government published emission factors for natural gas and electricity.

19.5 Mitigation

Operation of the OCGT using a natural gas blend with hydrogen up to and including 100% hydrogen will limit the generation of Scope 1 emissions during power generation operations.

Use of electric vehicles will also limit the generation of Scope 1 emissions arising from fuel combustion. However, this will be traded off against the Scope 2 emissions associated with purchased electricity.

19.6 Likely Significant Effects to be Considered in the EIA

All greenhouse gas emissions to the atmosphere can be considered as significant (see also Section 19.2.1), therefore the assessment will seek to quantify emissions and place them into context, with a focus on the main aspect of the Proposed Development which is likely to be the operational phase.

19.7 Effects Scoped out of the EIA

Hydrogen is considered an indirect GHG as it does not absorb infrared radiation, though if released in significant quantities can change the chemistry of the atmosphere and prolong the lifetime of other GHGs, notably methane. Fugitive emissions of hydrogen are therefore a concern, and work is ongoing to narrow the uncertainties of the global warming potential (GWP) impact and leakage rates from hydrogen production. Further research and development to reduce the main leak pathways and additional evidence gathering in key areas where there is currently inadequate data to make accurate predictions is recommended by the Department for Business, Energy & Industrial Strategy (BEIS), who currently require hydrogen producers to take the steps outlined below.

- Risk Reduction Plan: produce a plan demonstrating how fugitive hydrogen emissions at the production plant will be minimised.
- Risk Plan: Provide estimates of expected rates of remaining fugitive emissions by the plant.
- Risk Monitoring: prepare a monitoring methodology for fugitive hydrogen.

Consideration will be included of the CO_2 equivalent of the expected fugitive hydrogen emissions rates from process venting and flaring, equipment (for example compressors), on-site storage and pipework and fittings leaks. Estimated fugitive emissions rates will be taken from engineering calculations by the design contractor.

Evaluation of whether and how the potential future effects of climate change could affect the Proposed Development or exacerbate impacts identified by other technical topics will be addressed in other parts of the ES (mainly under section 7 ‘Geology and Ground Conditions’ and section 8 ‘Water Resources and Flood Risk’) and will not be considered under the climate change assessment.

19.8 Proposed Approach to the Assessment

19.8.1 Specific Methodologies

The method for the GHG assessment will broadly follow the IEMA guidance document (IEMA, 2017). This sets out the following process steps for the calculations:

- define scope and study boundaries.
- data collection.
- calculate GHG emissions; and
- sensitivity analysis to assess uncertainties.

Calculation of GHG emissions will be compatible with international standards and the low carbon hydrogen standard.

GHG emissions from the construction stage will be subjected to high-level screening calculations using values taken from published literature for the construction of similar facilities, scaled based on the area/length or operational capacity of the facility. If this screening step indicates that GHG emissions for construction are not significant (i.e. less than 10% of operational emissions over the 25-year lifetime), detailed calculations of construction emissions will not be undertaken. Similar considerations will apply to assessing decommissioning effects.

19.8.2 Assessment Criteria

There are no established thresholds for defining the significance of effects on climate in EIA resulting from GHG emissions of different magnitudes. The IEMA guidance states that "*in the absence of any significance criteria or a defined threshold, it might be considered that all GHG emissions are significant and an EIA should ensure the project addresses their occurrence by taking mitigating action"* and assessors should seek to contextualise GHG emissions, for example *"against sectoral, local or national carbon budgets*". However, The Climate Change Act 2008 does not impose any legal duties to require particular geographical areas within the UK to achieve particular reductions in carbon emissions by particular dates or any sector of the economy, including the energy sector, to achieve any particular target for carbon reductions. There is no national policy statements (NPS) or development policy provision that provides such targets, either. Therefore, in the absence of a baseline against which the likely significance of GHG emissions from the Proposed Development could be assessed at a local or regional level, the approach in this assessment will be to contextualise the predicted operational GHG emissions in a sectoral context. Therefore, no significance threshold has been set for the Proposed Development and the significance of effects on climate will be considered subjectively.

20. CUMULATIVE EFFECTS

20.1 Introduction

This section sets out the proposed approach to the assessment of the potential cumulative effects of the Proposed Development. Cumulative effects are defined by the European Commission (Walker and Johnston, 1999[153]) as "Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project".

Cumulative effects arise when the Proposed Development is considered together with effects from other planned projects or developments on the same single resource or receptor.

20.2 Policy and Legislative Context

Schedule 4 paragraph 5 of the 2017 EIA Regulations sets out the information that should be included in an ES and includes: "*A description of the likely significant effects of the development on the environment resulting from, inter alia: (e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources*".

The need to consider cumulative effects in planning and decision making is also set out in national planning policy. NPPF[154] paragraph 155 states: "*To help increase the use and supply of renewable and low carbon energy and heat, plans should: a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);"*

Paragraph 160, referring to flood risk requires that: "*Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards*."

Paragraph 185 addresses pollution and effects on human health and the natural environment: "*Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development*."

Paragraph 186 specifically covers air quality: "*Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas*."

20.3 Proposed Methodology Overview

The cumulative effects assessment (CEA) process for the EIA will follow a four-stage approach:

- Stage 1: identify the zone of influence and establish a long list of 'other existing development and/or approved development';
- Stage 2: identify a shortlist of 'other existing development and/or approved development' for the CEA;

[153] European Commission (1999) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*. Available online: https://ec.europa.eu/environment/archives/eia/eia-studies-and-reports/pdf/guidel.pdf

[154] Ministry of Housing, Communities and Local Governments (2021*) National Planning Policy Framework.* Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

- Stage 3: information gathering as required; and
- Stage 4: assessment.

The proposed application of the methodology for each stage is described in the following sections.

20.4 Stage 1 (establishing the long list of 'other existing development and/or approved development')

20.4.1 General Considerations

Stage 1 of the CEA methodology involves establishing the Proposed Development's Zone of Influence (ZoI) and identifying a long list of other developments for inclusion in the assessment.

The assessment will apply a proportionate approach in identifying other proposed developments that could contribute to impacts on the same receptors as the Proposed Development. The basic principles in applying the proportionate approach will be as follows.

All Nationally Significant Infrastructure Projects (NSIPs) and Transport and Works Act applications will be included for consideration.

With increasing distance from the Proposed Development, the CEA will progressively screen out other types of applications based mainly on their scale (as explained below).

The Proposed Development will have pollutant emissions to air. The search area will therefore be determined by the largest distance at which the Proposed Development could potentially have impacts, which for the purpose of this Scoping Report is taken to be 15 km from the main emission source.

20.4.2 Scale of Other Developments

Table 20-1 sets out the proposed scale and spatial parameters to be used to identify the long list of other developments for the CEA.

Table 20-1 Planning Categories Scale and Spatial Scopes

Category (Note 1)	Spatial scope
Nationally Significant Infrastructure Project: terrestrial project applications	15 km from the main emission source of the Proposed Development
Section 36 (including variations) and 37 of the Electricity Act applications	15 km from the main emission source of the Proposed Development
Transport Works Act Application: terrestrial project applications	15 km from the Proposed Development
Town and Country Planning Act 1990: consented developments that required an EIA under the EIA Regulations; applications that have been screened in for EIA; applications that have submitted an EIA screening request; applications that required a HRA, at least to screening stage, under the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations); and other applications and consented development included at the discretion of the local planning authority.	15 km from the Proposed Development

The CEA may also consider marine projects to the extent they have any potential to contribute to impacts on the same receptors as the Proposed Development.

Regarding development falling under the Town and Country Planning Act 1990, the CEA will primarily focus on consented development, development where a consent decision is pending, and pending applications (e.g., for which a screening opinion has been sought).

20.5 Stage 2 (establishing a shortlist of 'other existing development and/or approved development')

20.5.1 Temporal Considerations

The status of other development in terms of whether its construction could overlap in time with the Proposed Development construction phase is relevant in regard to the potential for cumulative construction-related impacts.

Where a construction period likely to overlap with the timeframe of 2024 to 2026 is identified within application documentation for other development, those other developments will be screened as 'possibly cumulative during construction' and the CEA will assess cumulative construction impacts. The other developments to be considered will be limited to a five-year period preceding the date of submission of the ES since planning permissions typically expire after a period of three to five years.

Taking a worst-case approach, the CEA will assume there will be overlapping operational phases for all the other developments with the operational phase of the Proposed Development, even though it is possible that some of these other developments may not proceed.

20.5.2 Technical Considerations

Not all the impacts of the Proposed Development could lead to cumulative effects with impacts from other developments. Also, for the Proposed Development to have cumulative impacts on the same receptor as other developments, the receptor would need to be within a ZoI for the impact concerned.

The topics, impacts and zones of influence detailed in **Table 20-2** have been identified as having the potential to contribute to cumulative impacts on receptors within the zones of influence for the type of impact under consideration. The ZoI takes into consideration the areas / receptors likely to be affected by the Proposed Development activities and facilities that are directly owned, operated, or managed (including by contractors) and that are a component part of the Proposed Development.

As the proposed zones of influence are defined by individual topics they vary.

Table 20-2 Proposed Development Impacts (and their ZoI) with Potential to Contribute to Cumulative Effects

Topic	Potential Impacts	ZoI
Air quality: construction	Dust generating activities during construction could act cumulatively on receptors with dust generating activities from other development in very close proximity. Traffic air quality impacts from the Proposed Development will be considered additively with current and projected road use levels and therefore be integrally addressed in the topic section.	Up to 350 m from the Proposed Development site boundary. N/A
Air quality: operation	The operation of the OCGT will be associated with NOx emissions which may have a cumulative impact with proposed/planned projects associated with NOx emissions in the Zone of Influence. As detailed emission information from other proposed/planned projects is not expected to be readily available, cumulative impacts will be assessed qualitatively.	Up to 15 km from the Proposed Development site boundary for the onshore elements.
Climate	The contribution of greenhouse gases emitted by the Proposed Development to global climate change will be an intrinsic part of the Climate Change assessment and require no additional consideration in terms of cumulative effects (noting that such emissions will be associated with the means of electricity supply to the Proposed Development rather than directly from its operation). This is also the case for fugitive and vented hydrogen, which	N/A

Topic	Potential Impacts	ZoI
	has an indirect GWP through its impact on atmospheric chemistry.	
Noise: construction	Construction noise from the Proposed Development could act cumulatively with noise from other developments on nearby receptors.	Up to 1 km from the Proposed Development site boundary for the onshore elements.
Noise: operation	Operational noise from the Proposed Development could act cumulatively with noise from other developments on nearby receptors.	Up to 1 km from the Proposed Development site boundary for the onshore elements.
Vibration: construction	Vibration is only likely to have a significant effect within 100 m of activities such as driven piling or use of vibratory compactors.	Up to 100 m from the Proposed Development site boundary for the onshore elements.
Ground conditions, contamination, and hydrogeology	Potential hydrogeology and ground contamination related impacts will be mitigated and limited to within the application site boundary; therefore, this matter is unlikely to result in significant cumulative effects and can propose to be scoped out of the CEA.	N/A
Water resources: construction	Construction aqueous wastes will be managed within the site and any effluent discharges will be required to meet the requirements of the Environment Agency in accordance with The Water Environment (Water Framework Directive) (England and Wales) Regulations. Potential cumulative effects with other discharges will be fully considered under the permitting process and therefore not considered further in the CEA.	N/A
Water resources: operation	Surface water will be managed within the site and any effluent discharges will be required to meet the requirements of the Environment Agency in accordance with The Water Environment (Water Framework Directive) (England and Wales) Regulations. Any process effluent discharges not treated on site will be required to meet the requirements of the Environmental Permitting (England and Wales) Regulations 2016. Potential cumulative effects with other discharges will be fully considered under these permitting processes and therefore not considered further in the CEA.	N/A
Flood risk	Residual flood risk to the Proposed Development and from the Proposed Development is anticipated to be low and will be entirely managed within the site. The Flood Risk Assessment will consider other development likely to occur within the wider area and so will inherently consider cumulative flood risk.	N/A
Ecology and nature conservation: construction	During construction, potential cumulative disturbance effects could occur with other developments being constructed in close proximity.	A conservative 2 km radius around the Proposed Development site boundary will be applied for construction disturbance to general fauna and local wildlife sites. A larger ZoI will be applied for national and European protected suites, comprising up to 2 km from the Proposed Development site boundary, plus 2 km from the parts of SPAs, SACs and SSSIs falling within the initial 2 km zone.
Ecology and nature conservation: operation	During operation, there will be some limited sources of disturbance that could contribute to cumulative effects with other developments in close proximity.	As above.

Topic	Potential Impacts	ZoI
Landscape and visual assessment: construction	Some limited and temporary activities may contribute to cumulative landscape and visual impacts along with impacts from other developments.	Zone of visual influence determined by modelling and professional judgement informed by site visit: up to a 5 km radius from the Proposed Development site boundary.
Landscape and visual assessment: operation	During operation other developments may contribute to cumulative landscape and visual impacts with the Proposed Development in terms of potential for inter-visibility.	Zone of visual influence determined by modelling and professional judgement informed by site visit: up to a 5 km radius from the Proposed Development.
Traffic and transport: construction and operation	Cumulative traffic effects will be assessed as a matter of course in the Traffic and Transport Assessment by including cumulative schemes and considering future growth of traffic flows due to general increase in road use by residents and businesses.	N/A
Socio-economic aspects	The Proposed Development will be set against a background of a variety of economic development activity and in a regional context will have small economic and employment benefits. However, it is not considered necessary for the purposes of the EIA to assess such cumulative positive impacts. Potential negative effects on people and human health and wellbeing are considered in the context of other topics (e.g. noise, air quality, traffic, and health).	Local Impact Area up to Regional N/A
Historic environment: construction	Construction effects on buried archaeology, should any occur, would be limited to within the Proposed Development site boundary therefore there is no scope for cumulative effects with other developments.	N/A
Historic environment: operation	The Proposed Development and other developments could potentially affect the setting of the same scheduled monuments.	Limited to the effect on the setting of scheduled monuments, 2 km.
Waste management: construction and operation	Cumulative effects will be considered as an inherent part of the waste assessment. The potential effects on the capacity of local waste management infrastructure will take into account the likely ongoing demands on such infrastructure from other developments and activities. No further assessment will therefore be required in the CEA.	N/A
Public health	Potential cumulative effects on public health will be considered in two ways: ■ under other relevant topics (e.g. air quality, noise etc.); and ■ the health impact assessment considers the combined effects of various factors that together could affect health (e.g., noise plus air quality). No further assessment will therefore be required in the CEA.	N/A

The possible cumulative effects of MA&D will be integrally considered under that topic. Such potential effects are effectively controlled through other legislation through the HSE. It should be noted that if a pre-construction safety report is required by the HSE, then this would address the possible consequences of (and the necessary controls for) a so-called 'domino effect': a major incident at the Proposed Development having knock-on effects at a neighbouring COMAH facility (e.g. Aldbrough 1) or vice versa.

The other developments identified and shortlisted at Stages 1 and 2 of the CEA will be presented in and ES, with details of their current status. Other developments will be progressively screened out, or

screened in, from the long list based primarily on temporal considerations and secondly on technical considerations (as explained above). Some other developments may also be immediately screened out by virtue of their very small scale and very low potential to have cumulative effects with the Proposed Development.

20.6 CEA Stages 3 and 4

Based on the outcome of Stages 1 and 2 of the CEA a number of other developments will be taken forward for further consideration in Stages 3 and 4 of the CEA. The number of other developments considered in each EIA topic is likely to vary depending on the size of the topic ZoIs and the likely nature of the impacts from the other developments (for example, a large housing development being constructed could be considered to have potential cumulative noise effects with the Proposed Development's construction, but to have no likely significant cumulative noise effects during operation of the housing development).

To the extent necessary, further information on the short-listed developments will be collected and considered in making the EIA topic assessments. Each topic will apply its standard assessment criteria in undertaking the CEA and the mitigation measures already committed to by the Proposed Development will be inherently considered. In considering the likely effects of other developments the CEA will assume that they would all be required to meet regulatory requirements and a standard of good industry practice. Each topic will also consider whether the cumulative effect of the Proposed Development plus other development would lead to a different (i.e. greater) level of significance than that for the Proposed Development alone.

21. SUMMARY AND NEXT STEPS

The information included in the Scoping Report is provided to support the Applicant's request for a Scoping Opinion from the ERYC in relation to the development of the Proposed Development.

The Scoping Report is intended to support engagement with ERYC and statutory consultees in the EIA process, inviting them to provide relevant information and to comment on the proposed approach to the EIA, to ensure that a robust and proportionate EIA is undertaken. This Scoping Report has identified the main aspects of the environment likely to be significantly affected by the construction, operation and decommissioning of the Proposed Development. For each of these identified aspects, the Scoping Report has identified the extent of relevant environmental studies to be undertaken as part of an EIA. The ES will outline the full EIA and will be submitted alongside the planning application and summary of Scoped Out Impacts

Sections 7 to 19 of this Scoping Report identify all the topics that are proposed and will be assessed during the EIA process.

Where possible, for some topics and sub-topics, provisional assessments have been made during the scoping exercise based on information for the site that is already available and from some early site visits (e.g. for ecology), and what is known about Proposed Development design at this stage. Furthermore, the status of the Proposed Development (i.e. predominantly industrial usage) and the knowledge obtained from undertaking previous environmental studies as part of evaluating several sites for the Proposed Development have assisted the present scoping process.

On the basis of the above considerations Sections 7 to 19 set out the technical scope for the EIA, and in some instances propose matters to be scoped out of the EIA. The sections seek to clearly set out how a topic/sub-topic will be taken forward in the EIA process and the degree of effort and emphasis that will be applied in each instance. For example, where the evidence base clearly indicates there is no scope for a likely significant effect, a sub-topic is scoped out. Where the impact and effects for a topic/sub-topic are clearly understood and management and mitigation measures of known effectiveness will be put in place, the EIA will consider such matters but will not necessarily examine them in great depth. Where there is uncertainty at this stage, the potential for likely significant effects, or the ability of the design to comply with legal standards needs to be demonstrated, the EIA will take the necessary steps in terms of such matters as site surveys, numeric modelling, and other detailed assessments to address such matters.

There are a number of interrelationships between the individual topics that will be considered in the course of the assessment. For example, the findings of the assessment of impacts on ecology and nature conservation will be strongly influenced by the findings of the noise and air quality assessments, amongst others.

The findings of the EIA, based on the application of the methodologies set out in Section 6, and topic-specific approaches in Sections 7 to 19, will be reported in the ES to be submitted as part of the planning application.

21.1 Next Steps

Once the Scoping Opinion has been obtained from the ERYC, preparations will be made for pre-application consultation and stakeholder engagement. The EIA and Proposed Development design will proceed with envelope refinement, further assessment, and analysis. The EIA will be undertaken and prepared with due regard to the requirements of Schedule 4 of the 2017 EIA Regulations. The ES will include an assessment of the predicted effects on the environment and people of the Proposed Development, focussing on the effects that have the potential to be significant.

A website will be developed to provide information and updates on the Proposed Development, and matters relating to the proposed application.

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