Environmental Impact Assessment Scoping Report

Aldbrough Hydrogen Storage Project

31 May 2023

Project No.: 0630444

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31 May 2023

Environmental Impact Assessment Scoping Report

Aldbrough Hydrogen Storage Project

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Acronyms and Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AGS	Aldbrough Gas Storage
AHS	Aldbrough Hydrogen Storage
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALRA	Abnormal Load Route Assessment
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
BAP	Biodiversity Action Plan
BCT	Bat Conservation Trust
BGL	Below Ground Level
BGS	British Geological Survey
BNG	Biodiversity Net Gain
BNL	Basic Noise Level
BoCC	Birds of Conservation Concern
BS	British Standard
CEA	Cumulative Effects Assessment
CCS	Carbon Capture and Storage
CDM	Construction (Design and Management)
CEMP	Construction Environmental Management Plan
CIfA	Chartered Institute for Archaeologists
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CLG	Community Liaison Group
COMAH	Control of Major Accident Hazards
CoCP	Code of Construction Practice
CORE	Centre for Offshore Renewable Engineering
CoP	Code of Practice
CoPA	Control of Pollution Act
CPA	Central Processing Area
CRTN	Calculation of Road Traffic Noise
cSCA	Candidate Special Area of Conservation
CSM	Conceptual Site Model
CTMP	Construction Traffic Management Plan
dB	Decibels
DBA	Desk-Based Assessment
DCO	Development Consent Order

Abbreviation	Definition
DECC	Department for Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
DMRB	Design Manual for Roads and Bridges
DMV	Deserted Medieval Village
DoW: CoP	Definition of Waste: Development Industry Code of Practice
DSA	Detailed Study Area
EA	Environment Agency
EA	Environmental Assessment
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
EPA	Environmental Protection Act
EPC	Engineering, Procurement and Construction
EPS	European Protected Species
ERM	Environmental Resources Management
ERP	Emergency Response Plan
ERYC	East Riding of Yorkshire Council
ERYCBAP	East Riding of Yorkshire Biodiversity Action Plan
ES	Environmental Statement
EU	European Union
EUDCF	European Union Data Collection Framework
FEED	Front-end Engineering and Design
FL	Flight Level
FRA	Flood Risk Assessment
GES	Good Environmental Status
GHG	Greenhouse Gas
GIS	Geographical Information System
GCN	Great Crested Newt
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPP	General Pollution Plan
GVA	Gross Value Added
HAA	Heavy Anti-Aircraft
HAZID	Hazard Identification
HDD	Horizontal Direction Drilling
HF	High Frequency
HHER	Humber Archaeology Partnership Historic Environmental Record
HGV	Heavy Goods Vehicles

Abbreviation	Definition
HIA	Health Impact Assessment
HRA	Habitats Regulations Assessment
HSA	Hazardous Substances Authority
HSC	Hazardous Substance Consent
HSC	Historic Seascape Characterisation
HSE	Health and Safety Executive
HSWA	Health and Safety at Work etc. Act
IAQM	Institute of Air Quality Management
IDB	Internal Drainage Board
IECS	International Council for Exploration of the Sea
IEF	Important Ecological Features
IEMA	Institute of Environmental Management and Assessment
IFCA	Inshore Fisheries and Conservation Authority
IMO	International Maritime Organisation
IUCN	International Union for Conservation of Nature
JNCC	Join Nature Conservation Committee
LCA	Landscape Character Area
LCT	Landscape Character Type
LF	Low Frequency
LNG	Liquified Natural Gas
LNR	Local Nature Reserve
LPA	Local Planning Authority
LOAEL	Lowest Observed Adverse Effect Level
LoW	List of Waste
LSOA	Lower Layer Super Output Area
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
MA&D	Major Accidents and Disasters
MAGIC	Multi Agency Geographic Information for the Country
MCAA	Marine and Coastal Access Act
MAH	Major Accident Hazards
MCM	Million Cubic Metres
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
MIT	Mechanical Integrity Test
MLS	Mean Landing Size
MMO	Marine Management Organisation
MoD	Ministry of Defence

Abbreviation	Definition
MPA	Marine Plan Area
MPA	Marine Protected Area
MPS	Marine Policy Statement
MSFD	Marine Strategy Framework Directive
NBN	National Biodiversity Network
NCA	National Character Area
NERC	Natural Environment and Rural Communities
NESFC	North Eastern Sea Fisheries Committee
NIA	Nature Improvement Area
NHS	National Health Service
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPSE	Noise Policy Statement for England
NO_2	Nitrogen Dioxide
NOAEL	No Observed Adverse Effect Level
NOMIS	Office for National Statistics Labour Market Profiles
NOx	Nitrogen Oxides
NSCA	National Seascape Character Area
NSIP	Nationally Significant Infrastructure Project
NSR	Noise Sensitive Receptor
NVZ	Nitrate Vulnerable Zone
O&M	Operation and Maintenance
OGA	Oil and Gas Authority
ONS	Office for National Statistics
OTMP	Operational Traffic Management Plan
OWF	Offshore Wind Farm
PAD	Protocol for Archaeological Discovery
PAM	Passive Acoustic Monitoring
PEIR	Preliminary Environmental Impact Report
PEXA	Practice and Exercise Areas
PPE	Personal Protective Equipment
PPG	Planning Practice Guidance
PPG	Pollution Prevention Guidelines
PRoW	Public Right of Way
PM	Particulate Matter
PTS	Permanent Threshold Shift
pSPA	Potential Special Protection Area
RNLI	Royal National Lifeboat Institution

Abbreviation	Definition
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAR	Search and Rescue
SCI	Sites of Community Importance
Sm3	Standard Cubic Metres
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SCG	Single Conversation Group
SLVIA	Seascape, Landscape and Visual Impact Assessment
SOAEL	Significant Observed Adverse Effect Level
SoS	Secretary of State
SPA	Special Protection Area
SPL	Sound Pressure Levels
SMV	Shrunken Medieval Village
SSC	Suspended Sediment Concentration
SSE	Scottish and Southern Electric
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Urban Drainage System
SVR	Seascape and Visual Resources
SWMP	Site Waste Management Plan
TA	Transport Assessment
TCE	The Crown Estate
TCPA	Town and Country Planning Act
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift
UAEL	Unacceptable Adverse Effect Level
UKHO	United Kingdom Hydrographic Office
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
UK	United Kingdom
UXO	Unexploded Ordnance
VHF	Very High Frequency
VMS	Vessel Monitoring System
VP	Viewpoint
WFD	Water Framework Directive
WHO	World Health Organisation
WHS	World Heritage Site
WMP	Waste Management Plan

Abbreviation	Definition
WRAP	Waste and Resources Action Programme
YNYERH	York, North Yorkshire, East Riding and Hull
ZOI	Zone of Influence
ZTV	Zone of Theoretical Visibility

1. INTRODUCTION

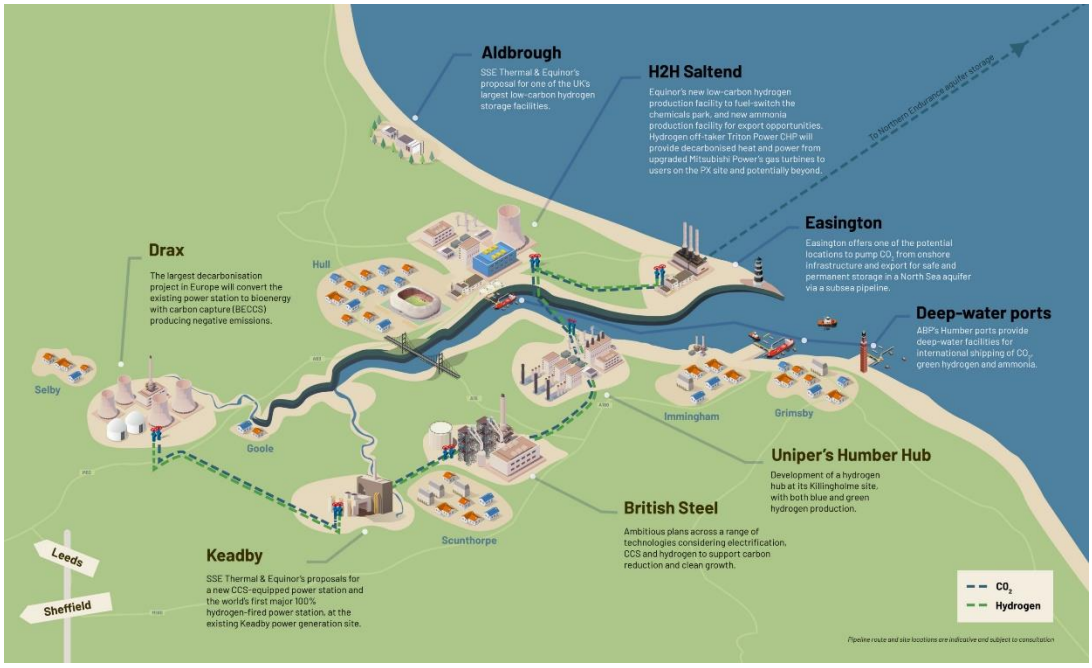
1.1 Purpose of this Report

1.1.1.1 Equinor New Energy Limited (hereafter referred to as 'the Applicant') and SSE Thermal are proposing to construct and operate an underground hydrogen storage facility known as the Aldbrough Hydrogen Storage (AHS) Project at Aldbrough in the East Riding of Yorkshire (hereafter referred to as 'the Proposed Development').

1.1.1.2 Hydrogen storage is a strategically important asset class in supporting the delivery of the UK Government's legally binding net zero targets. The Proposed Development is one of many projects working to deliver a net zero future as well as decarbonising the Humber, creating the world's first net zero industrial region by 2040.

1.1.1.3 Key to that ambition is the Zero Carbon Humber (see Figure 1.1), a coalition of international energy producers, major regional industries, leading infrastructure and logistics operators, global engineering firms and academic institutions.

Figure 1.1: The 'Zero Carbon Humber' Initiative



1.1.1.4 The Proposed Development will be supplied with the hydrogen for storage from various low-carbon production facilities in the Humber region. The low-carbon local storage of hydrogen will offer a supply of gas to various users across the region. The location of the Proposed Development is illustrated by the Scoping Boundary in Figure 1.2.

1.1.1.5 The hydrogen for the Proposed Development will be provided via a new pipeline connecting producers and users across the Humber area. The proposed hydrogen pipeline will be consented as part of a separate application.

1.1.1.6 The Proposed Development is located adjacent to the existing SSE Thermal operated Aldbrough Gas Storage facility (hereafter referred to as 'Aldbrough Gas Storage (AGS)') as shown on Figure 1.3. AGS, which is a joint venture between SSE Thermal and Equinor, has

the capacity to store around 330 million cubic metres (mcm) of natural gas in multiple caverns[1]. AGS comprises a central processing area linked to nine subsurface salt caverns.

1.1.1.7 The key components of the Proposed Development are:

- the **storage facility** (hereafter referred to as 'the Hydrogen Storage Facility') comprising:
  - up to nine subsurface caverns created in the underlying salt horizons by solution mining and each cavern connected to the surface by a well;
  - a central processing area which will include supporting surface infrastructure, such as compressors, dehydration units, workshops, vents etc;
  - a wellhead and leaching area connecting the caverns to the surface facilities and the proposed location of drilling and leaching infrastructure;
- the **marine infrastructure** required to facilitate the solution mining of the caverns, which will include pipelines to the North Sea for the abstraction of sea water and the return of extracted brine (hereafter referred to as 'the Marine Infrastructure').

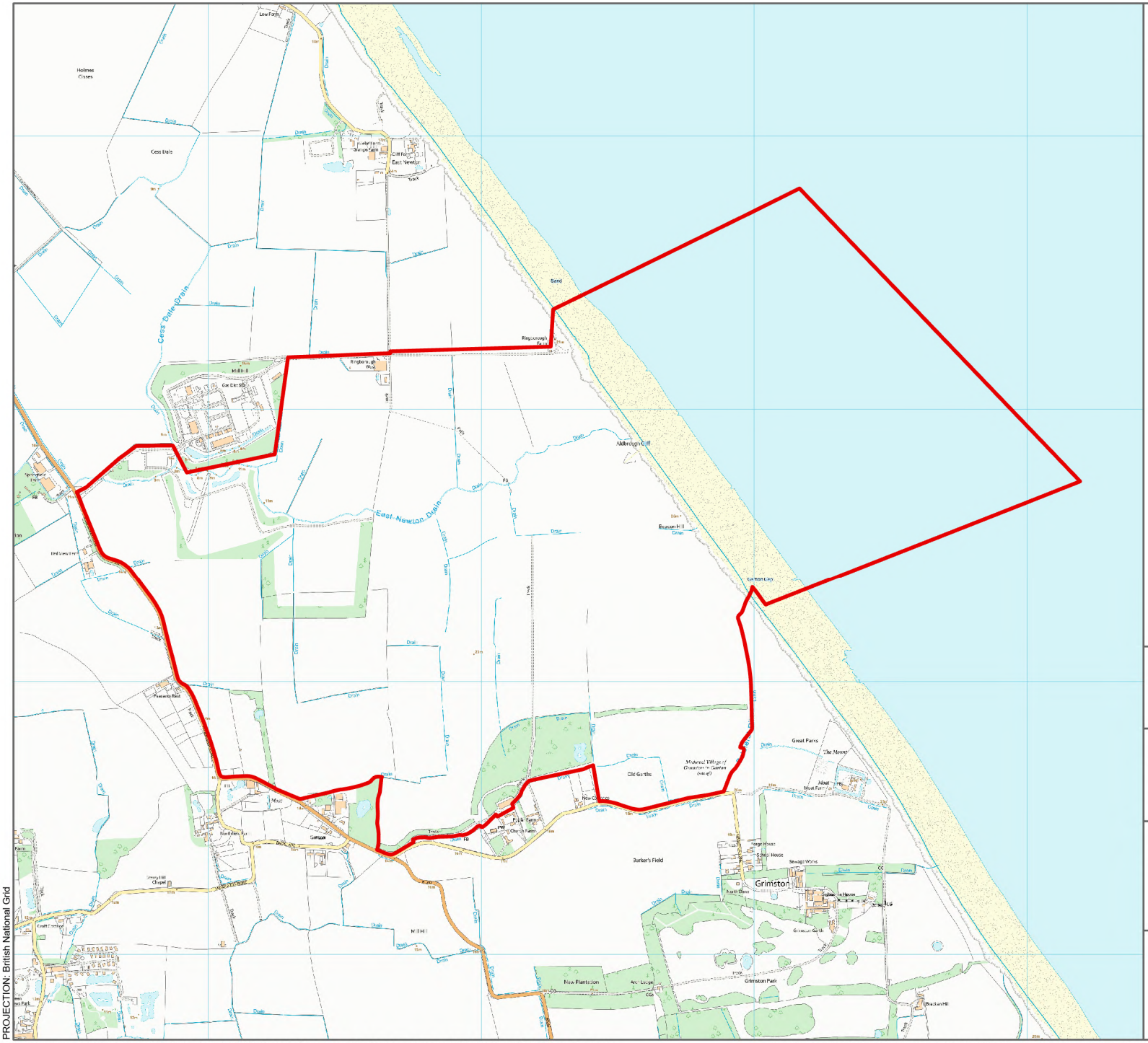
1.1.1.8 To initiate the Development Consent Order (DCO) process the Applicant has prepared this Environmental Impact Assessment (EIA) Scoping Report ('the Scoping Report'), which presents an initial consideration of the likely significant effects associated with the construction, operation, maintenance, and eventual decommissioning of the Proposed Development. The purpose of the Scoping Report is to request a formal Scoping Opinion from the Secretary of State (SoS) in accordance with Regulation 10 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (hereafter referred to as the '2017 EIA Regulations') and to ensure a proportionate EIA. The benefits of delivering proportionate EIA[2], are to:

- drive collaborative action and understanding across the EIA community;
- focus assessments so their findings are accessible to all stakeholders;
- reduce uncertainty and risk within project consenting;
- save time and costs for developers, consenting authorities and consultees; and
- allow more time to be spent exploring the delivery of environmental improvements.

1.1.1.9 One of the key actions for delivering a proportionate EIA is to improve scoping allowing it to become a core process running through the EIA, which presents ongoing opportunities to define and redefine what information is of value and how it is made available to stakeholders. Therefore, an integral element of this report is to focus on aspects which the Applicant believes can be scoped out in the interest of proportionality. The Preliminary Environmental Information Report (PEIR) and subsequently the Environmental Statement (ES), which reports the proportionate EIA, will be based on the Scoping Opinion, informed by the recommendations of the consultees and the information contained within this Scoping Report.

[1] The Planning Act 2008 defines "Underground gas storage facilities" as "facilities for the storage of gas underground in caverns or in porous strata. Use of the term "cavern" or "cavern" can be therefore be used but "cavern" has been used in this Scoping Report.

[2] As defined by the Institute of Environmental Management and Assessment (IEMA) (2017). Available online at: https://www.iema.net/download-document/7014.



© Crown copyright and database rights 2023
Ordnance Survey 0100031673

0 200 400 600 800 1,000
Metres

N

SCALE: See Scale Bar	VERSION: A06
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PROJECT: 0630444	CHECKED: CC
DATE: 28/04/2023	APPROVED: ES

Figure 1.2
Scoping Boundary

ERM

equinor

PROJECTION: British National Grid

Esri, Intermap, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Natural England

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - PJ - Scoping Boundary - A06

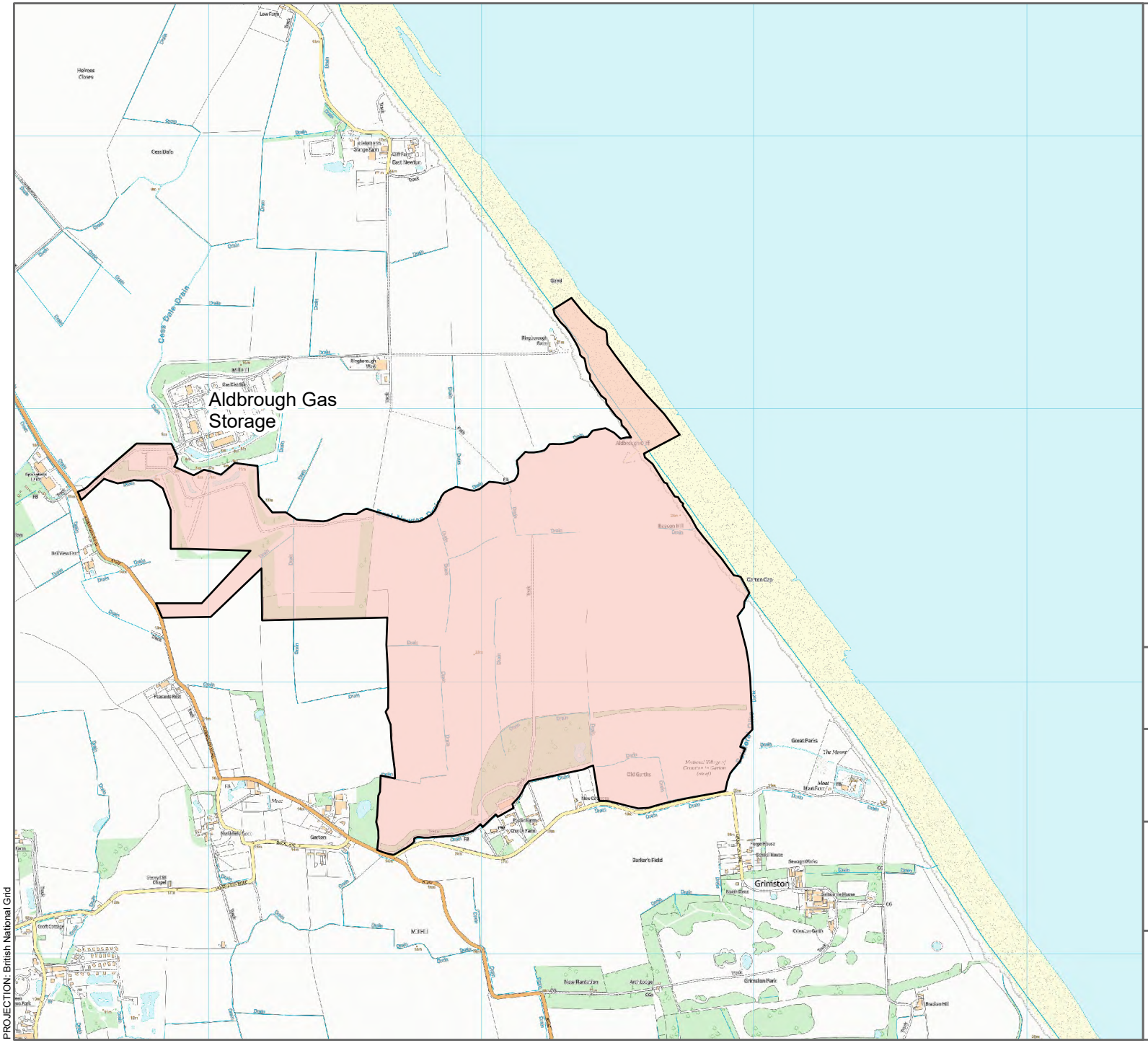
1.2 Project Background

1.2.1.1 Part of the site has previously secured planning permission pursuant to the Town and Country Planning Act 1990 for the solution mining of nine underground natural gas storage caverns and associated infrastructure and landscaping. This was granted on 30 October 2007 with reference DC/06/09372/STPLFE/STRAT and is hereafter referred to as 'AGS Extension' and the 'AGS Extension Planning Permission' (see Figure 1.3). Whilst some initial enabling and landscaping works were undertaken, the gas caverns were not created.

1.2.1.2 The enabling works comprised the construction of earth bunds around the proposed AGS Extension surface infrastructure and the planting of trees to screen the proposed facility and to help mitigate environmental impacts.

1.2.1.3 The above ground infrastructure for the Hydrogen Storage Facility will be constructed and operated within the existing footprint of AGS Extension and will therefore benefit from the earth bunds and mature trees that now surround this part of the Proposed Development. Each of the new caverns will be directionally drilled and solution mined from the Wellhead and Leaching Area located within the screened areas.

1.2.1.4 Seawater will be abstracted from the North Sea and brine, resulting from the solution mining, will be discharged back into the sea. New infrastructure will be required to support these operations including new below ground pipelines, seawater and brine storage facilities pumping facilities, seawater intake and a diffuser.



Aldbrough Gas Storage Extension

0 250 500 750 1,000
Metres

N

SCALE: See Scale Bar	VERSION: A03
SIZE: A4	DRAWN: HD
PROJECT: 0630444	CHECKED: AA
DATE: 05/05/2023	APPROVED: AA

Figure 1.3
Previous Project Boundaries

ERM

equinor

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - Scoping Boundary and Previous Boundaries - A03

1.3 Notification that DCO Application will be accompanied by an ES

1.3.1.1 The Applicant hereby gives notice, pursuant to Regulation 8(1)(b) of the 2017 EIA Regulations, that the application for a DCO will be accompanied by an ES. The ES will include at least the information set out in Regulation 14(a) – (e) and any additional information specified in Schedule 4 relevant to the specific characteristics of the Proposed Development and to the environmental features likely to be significantly affected. It will include the information reasonably required for reaching a reasoned conclusion on the likely significant effects of the Proposed Development.

1.4 Request for Scoping Opinion

1.4.1.1 This Scoping Report supports a request for a formal EIA Scoping Opinion. The Scoping Opinion will contain a compilation of responses to this document from statutory and other key stakeholders, which will guide the Applicant in progressing an EIA for the Proposed Development. The Applicant requests that the SoS sets out in writing their opinion of the scope of work, and level of detail of information to be provided in the ES. This Scoping Report contains the following information:

- a description of the Proposed Development, including its location and technical capacity;
- an explanation of the likely significant effects on the environment;
- such other information the Applicant considers material; and
- a plan sufficient to identify the land.

1.4.1.2 An illustration of the Proposed Development and a brief description of the nature and purpose of the Proposed Development and its possible effects on the environment are provided in **Chapter 2** and **Chapters 6 to 8** respectively. The individual topic areas within **Chapters 6 to 8** include matters of particular importance that the Applicant would like consultees to consider and respond to within the Scoping Opinion.

1.5 Competence

1.5.1 The Applicant

1.5.1.1 Equinor is one of the UK's leading energy providers. Equinor's energy supplies from Norway meet more than one quarter of the UK's demand for natural gas and around one fifth of its demand for oil, both produced with one of the lowest carbon footprints in the industry. It is also investing billions of pounds in critical energy infrastructure. These include Hywind Scotland (the world's first floating offshore wind farm) and Dogger Bank (the world's largest offshore wind farm which is starting generation in 2023).

1.5.1.2 Equinor is committed to investing in low carbon energy now. With an open and collaborative approach, working alongside industry peers, Equinor delivers long-term value to the communities in which it operates. Equinor is proud to collaborate with industry leaders to deliver cleaner growth within the Humber region, whilst taking into account the global potential and environmental impact of its operations.

1.5.1.3 SSE Thermal is part of the FTSE-listed SSE plc, the UK's clean energy champion. SSE Plc develops, builds, operates and invests in world-class electricity infrastructure that is vital to the clean energy transition. This includes onshore and offshore wind farms, hydro, electricity transmission and distribution networks, power stations, carbon capture and hydrogen, solar and batteries, as well as providing energy products and services for businesses and other customers. SSE plc has set a target to reduce the carbon intensity of the electricity it generates by 80% by 2030 (from a 2018 baseline) and is committed to being operationally net zero by 2050.

1.5.1.4 Through its flexible generation and gas storage sites, SSE Thermal plays a crucial role in keeping the lights on across the UK and Ireland by providing vital backup to renewables. The business has a clear focus on decarbonising its operations and is pioneering low-carbon technologies including carbon capture and hydrogen. In collaboration with Equinor, SSE Thermal is developing world-leading projects using these innovative technologies, helping to solve the challenge of low-carbon flexible energy while decarbonising the industrial heartlands in which it operates and ensuring a just transition for workers and communities.

1.5.2 The EIA Team

1.5.2.1 The preparation of the EIA is being led by Environmental Resources Management Ltd (ERM). ERM is supported by its subsidiary companies (Arcus, ESC and MarineSpace) providing local technical knowledge and resources across environmental and safety studies. Pursuant to Regulation 14(4) of the 2017 EIA Regulations, the ES will be prepared by competent experts and the ES will outline the relevant expertise or qualifications of the experts.

1.6 General Approach to Scoping Matters In and Out

1.6.1.1 This Scoping Report has been produced in accordance with the 2017 EIA Regulations and other guidance documents (see **Section 5.2**). In particular, the Planning Inspectorate Advice Note Seven (June 2020, version 7)[3] observes that, although not a statutory requirement, the Scoping Opinion is an important document, and the 2017 EIA Regulations require the ES to be based on the most recently adopted. The note identifies that the scoping process allows for an early identification of the likely significant effects applicable to the EIA Regulations and also provides an opportunity to agree where aspects and matters can be scoped out of further assessment.

1.6.1.2 Section 5.10 of Advice Note Seven highlights the essential need to allow the ES to be appropriately focused on aspects and matters where a likely significant effect may occur, and thereby ensuring that the EIA process is proportionate. This includes scoping out the need for further assessment of technical aspects and matters where it is appropriate to do so. Advice Note Seven goes on to advise that applicants should draft their scoping request to include sufficient justification for scoping aspects/matters out, and that this justification should be evidence-based and have reference to the assessment process.

1.7 Report Content and Structure

1.7.1.1 The remainder of the Scoping Report contains the following:

- Chapter 2 - an overview of the Proposed Development;
- Chapter 3 - an outline of relevant policy, standards, and guidance;
- Chapter 4 - outlines the options considered for the Proposed Development;
- Chapter 5 - describes the overall approach to the EIA;
- Chapter 6 outlines the potential effects of the terrestrial elements of the Proposed Development (the Hydrogen Storage Facility and the terrestrial elements of the Marine Infrastructure) for each topic. This includes:
    - Geology and Ground Conditions

[3] Planning Inspectorate Advice Note Seven (June 2020 (version 7)). Available online at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-seven-environmental-impact-assessment-process-preliminary-environmental-information-and-environmental-statements/.

  - Water Resources and Flood Risk
  - Air Quality
  - Noise and Vibration
  - Ecology and Nature Conservation
  - Landscape and Visual Assessment
  - Historic Environment
  - Traffic and Transport
- Chapter 7 outlines the potential effects of the Marine Infrastructure of the Proposed Development for each topic. This includes:
  - Physical Environment and Water Quality
  - Benthic and Intertidal Ecology
  - Fish and Shellfish Ecology
  - Marine Mammals
  - Marine Archaeology
  - Commercial Fisheries
  - Seascape and Visual Resources
  - Infrastructure and Other Users
  - Shipping and Navigation
- Chapter 8 outlines the potential effects of all the Proposed Development for each topic. This includes:
  - Socio-economic Aspects
  - Waste Management
  - Major Accidents and Hazards
  - Human Health
- Chapter 9 outlines the Cumulative Effects
- Chapter 10 provides a Summary and Next Steps.

2. PROPOSED DEVELOPMENT DESCRIPTION

2.1 Introduction

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

- the Hydrogen Storage Facility including salt caverns and above ground infrastructure; and
- the Marine Infrastructure to support the solution mining of the salt caverns.

2.1.1.2 It also provides an overview of the key activities that will be undertaken during construction, operation and maintenance (O&M), and decommissioning, including key parameters and indicative timescales.

2.1.1.3 At this early design stage (Pre- Front-end Engineering and Design (FEED)) in the Proposed Development, the Proposed Development description is indicative and the 'envelope' has been designed to include sufficient flexibility to accommodate further refinement of the design throughout the EIA process. This chapter therefore sets out parameters and maximum values to be used to constitute a realistic Maximum Design Scenario (MDS) for the Proposed Development for the purposes of obtaining a scoping opinion.

2.1.1.4 The Proposed Development description will continue to be based on a realistic MDS but will be refined through the design, consultation, and EIA processes; in the next stage within the PEIR; and finally, within the ES that will accompany the application for Development Consent to the SoS.

2.2 Design Envelope Approach

2.2.1.1 The Design Envelope approach is widely recognised and is consistent with the Planning Inspectorate Advice Note Nine: Rochdale Envelope (July 2018 (version 3)) which states that: *"The 'Rochdale Envelope' is employed where the nature of the Proposed Development means that some details of the whole project have not been confirmed (for instance the precise dimensions of structures) when the application is submitted, and flexibility is sought to address uncertainty*".

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

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

2.3 The Scoping Boundary

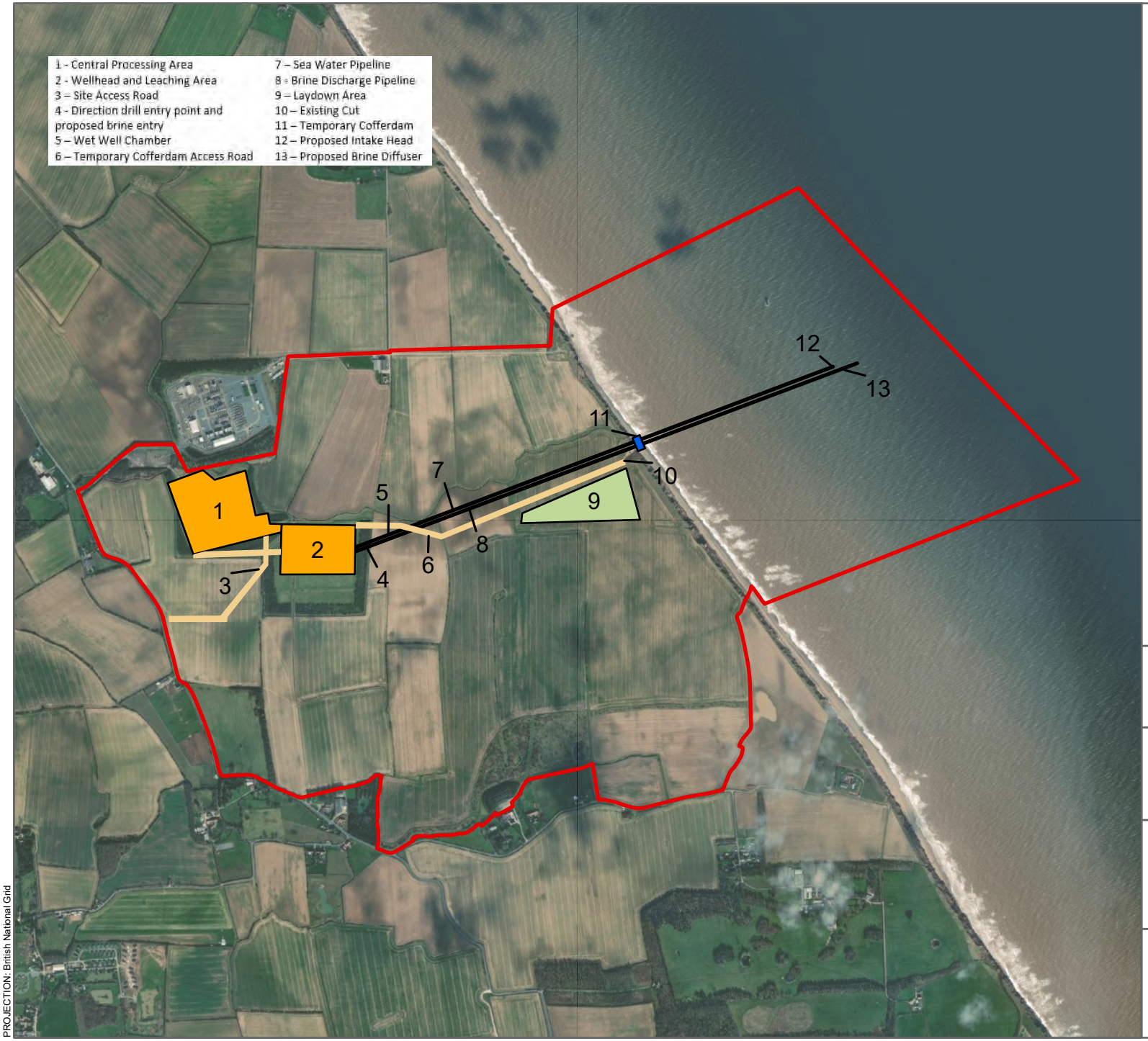
2.3.1.1 Figure 1.2 illustrates the 'Scoping Boundary' that has been used to inform this Scoping Report. The Scoping Boundary is defined as the area within which it is currently understood the Proposed Development will be physically located, including the temporary work areas. The Scoping Boundary should 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. The application boundary will be refined between scoping and the release of the PEIR for consultation.

2.4 Proposed Development Overview

2.4.1 Overview

2.4.1.1 This section of the report provides an overview of different elements of the Proposed Development (see Figure 2.1), namely:

- The Hydrogen Storage Facility (**Section 2.4.2**); and
- The Marine Infrastructure (**Section 2.4.3**).



Scoping Boundary
Above Ground Infrastructure
Access Road
Laydown Area
Temporary Cofferdam

Not drawn to scale

0 250 500 750 1,000
Meters

N

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: HD
PROJECT: 0630444	CHECKED: GB
DATE: 25/05/2023	APPROVED: ES

Figure 2.1
Indicative layout of the Proposed Development (excluding caverns)

ERM

equinor

PROJECTION: British National Grid

Maxar, Microsoft, Natural England

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - Indicative Layout - A01

2.4.2 Hydrogen Storage Facility

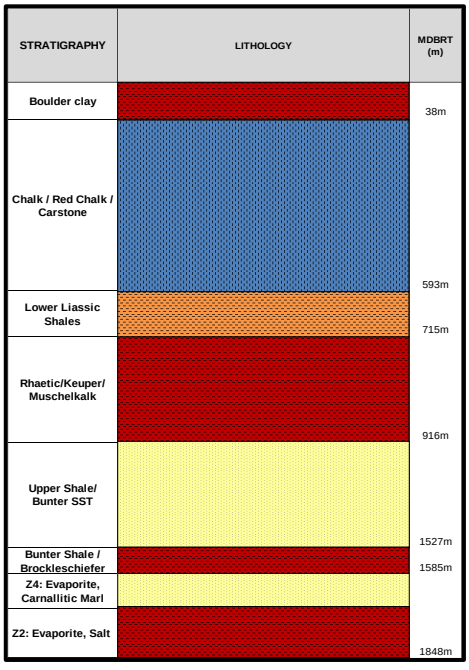
Underground Hydrogen Storage

2.4.2.2 Up to nine caverns with a total storage volume of up to 420,000,000 standard cubic metres (Sm^3) will be created in deep-underground salt formations for the specific purpose of safely storing the hydrogen. These design parameters are consistent with the previous planning consent for the AGS Extension. The aim will be to use abstracted sea water that will be injected into the salt formation via wells in a strictly controlled manner to shape the caverns through dissolution of the salt.

Site Geology

2.4.2.3 The caverns will be situated within the Z2 Main Salt layer of the Zechstein Group (see Figure 2.2) which was deposited during the Upper Permian and is the same as that of AGS. Highly soluble salts (likely carnallite) are anticipated to be present in the upper section of the Z2 Main Salt, with the carnallitic content and the thickness of the carnallitic zone increasing from west to east. Along the western edge of the Scoping Boundary is likely to contain little to no carnallite. The cleaner halite will be typically found near the base of the Z2 Main Salt with a reduced amount of insoluble material. The encountered geological layering and especially the thickness and distribution of the Z2 salt layer geology, is considered suitable for the development of up to nine caverns located at depths of between 1750 m to 1950 m below ground level (bgl).

Figure 2.2: Site Geology



Surface Layout and Design

2.4.2.4 Given the nature of the Proposed Development, the majority of the development activity will be present below ground. However, a degree of above-ground processing will be required to operate the Hydrogen Storage Facility. Although the configuration and layout are still to be confirmed, the Hydrogen Storage Facility will involve the provision of the following surface components:

- a central processing area (CPA) covering approximately 5.75 ha with connections between the CPA and wellheads including access roads;
- a wellhead and leaching area with associated facilities for all of the caverns. This will include a single hydrogen vent or a flare; and
- the proposed hydrogen pipeline connection.

Central Processing Area

2.4.2.5 The CPA will likely be located to the south of the existing AGS. The Hydrogen Storage Facility CPA will require an area of approximately 5.75 ha.

2.4.2.6 The buildings within the CPA will include a control building and workshop. In addition, the gas processing plant will include compressor trains, withdrawal trains, laydown / storage areas and electrical equipment. It will be contained within an existing landscape bund.

Wellhead and Leaching Area

2.4.2.7 The wellheads of the proposed underground caverns will be located in a separate wellhead and leaching area situated south-east of the CPA. The wellheads will be spaced to allow safe maintenance/interventions during operations. Each wellhead will be connected to the hydrogen caverns most likely using directionally drilled wells.

2.4.2.8 The wellhead and leaching area will comprise a local equipment room, leaching pumps, accommodation cabin, water reservoirs, welfare facilities and wellhead. It will be contained within an existing landscape bund. A vent or flare will also be located within the leaching and wellhead area.

Proposed Hydrogen Pipeline Connection

2.4.2.9 The Hydrogen Storage Facility will be connected to the future hydrogen pipeline network via a new pipeline. This will allow the future transportation of hydrogen via a pipeline into and out of the Proposed Development. This pipeline will be the subject of a separate consent application.

2.4.3 Marine Infrastructure

Onshore Pump and Wet Well

2.4.3.2 A pipeline is required to support the abstraction of sea water to leach the salt and form the caverns and a second pipeline is required to return ‘brine’ for discharge into the sea.

2.4.3.3 This design will comprise the following elements:

- onshore pipelines between the sea and a deep ‘wet well’ located approximately 450m to the west of the coastal cliffs;
- sea water pipelines extending from the Directional Drill Entry Point (Figure 2.1) via the wet well, below the cliff and into the sea, connecting to an intake head for the abstraction of sea water; and
- brine discharge pipeline extending from the drilling point, running adjacent to the sea water pipeline under the cliff and into the sea, connecting to a brine diffuser for the discharge of saturated brine. Note the brine discharge pipeline does not interface with the wet well.

2.4.3.4 The ‘wet well’ will be located onshore and approximately 450 m back from the cliff face and will likely be lined with pre-cast concrete sections. Once constructed, the wet well will be hydraulically connected to the sea and it will house the pumping infrastructure which will be

suspended in the ponding water at the base of the well. The sea water will then be pumped to a sea water reservoir located in the wellhead and leaching area.

2.4.3.5 A temporary cofferdam will be constructed on the beach at the base of the cliff (see Figure 2.1). This will be used to connect the pipework from offshore to onshore. The cofferdam will likely comprise steel sheet piles on all four sides and will be removed following construction.

2.5 Construction

2.5.1 Overview

2.5.1.1 This section provides an overview of the construction of the Proposed Development split into the main components of:

- The Hydrogen Storage Facility (**Section 2.5.2**); and
- The Marine Infrastructure (**Section 2.5.3**).

2.5.1.2 Construction is scheduled to commence from earliest 2026 and operations are anticipated to start from earliest 2029. The construction of the Proposed Development will also be front loaded due to the period of time required to construct the caverns and the need for the Proposed Development to be operational prior to the end user facilities commencing operation.

2.5.1.3 A new access to the Proposed Development from the B1242 Aldbrough Road will be created. As part of AGS, a designated haulage route for construction and operational traffic over 3 tonnes was approved. This approved route included the provision of a link road to prevent construction vehicle movements within the village of Aldbrough. Assuming that traffic is travelling from Hull, the approved route for heavy goods vehicles (HGV) is along the A165, the B1238 through Bilton and Sproatley and then using the link road to access the Hydrogen Storage Facility via the B1242.

2.5.2 Hydrogen Storage Facility

2.5.2.1 The construction and commissioning sequence of the Hydrogen Storage Facility will be as follows:

- enabling works for the above ground infrastructure including clearance, hardstanding, security and welfare;
- CPA civils work including installing foundations, pipe supports;
- installing major equipment;
- piping fit out;
- constructing structures and welfare units;
- electrical fit out;
- installing control and instrumentation;
- commissioning injection train; and
- commissioning withdrawal train.

2.5.3 Marine Infrastructure

Temporary Foreshore Cofferdam

2.5.3.1 The seawater intake and brine outfall pipes will be installed between the marine trench and the Directional Drill Entry Point (Figure 2.1) most likely using Horizontal Direction Drilling

('HDD'). A temporary cofferdam will be constructed on the beach at the lower end of the directional drill in which the connections to the marine pipelines will be made. The temporary cofferdam effectively has two purposes:

- to facilitate the installation of the pipework from the HDD compound to the beach; and
- to facilitate the connection of this pipework to the pipework to be buried between the beach and the seawater intake structure and brine diffuser.

2.5.3.2 The cofferdam will be sealed on the seaward side during directional drilling operations with sheet piling or a clay bund, however sections of the wall will be temporarily removed during pulling-in of the pipe sections for the directional drills. This seaward barrier will also be temporarily removed during connection of the marine pipelines to those installed in the directional drills.

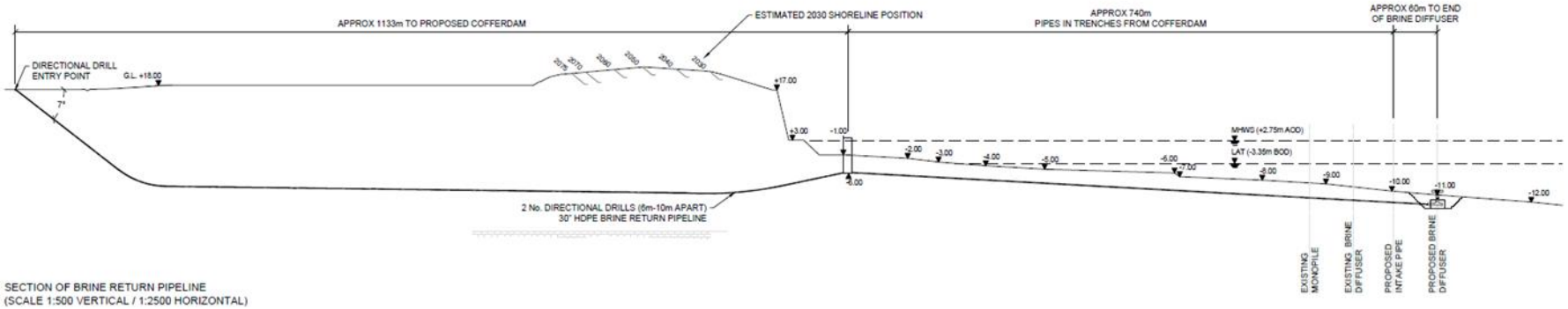
2.5.3.3 A temporary vehicle access to the beach will be constructed at the cliff and restored upon completion of the beach works.

Marine Pipelines and Other Infrastructure

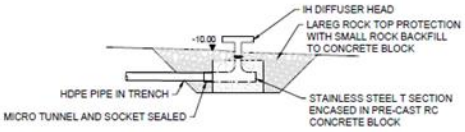
2.5.3.4 Figure 2.3 presents the likely cross section and diffuser. The method of construction of the marine pipelines has yet to be determined and is likely to comprise:

- directional drilling under the cliffs and seabed to a point beyond the mean high water mark i.e. the temporary foreshore cofferdam;
- trenching and backfilling with excavated sediments;
- placement of intake heads and diffusor heads. These are relatively small structures made from stainless steel; and
- abstraction and discharge of seawater for the solution mining process and subsequent discharge of brine water. The discharge rate for both abstraction and discharge will be approximately 1000 m3/hr.

Figure 2.3: Indicative cross section of Marine Infrastructure [4]



SECTION OF BRINE RETURN PIPELINE
(SCALE 1:500 VERTICAL / 1:2500 HORIZONTAL)



ENLARGED DETAIL ON INTAKE & BRINE DIFFUSER
(SCALE 1:200)

[4] This includes discharge tunnel and detail of discharge diffuser. The intake figure is similar.

2.6 Drilling and Leaching

2.6.1 Overview

2.6.1.1 There are three stages to the construction of salt caverns for gas storage: drilling of the well; leaching of the cavern; and conversion of the leached cavern to gas service. This section describes the drilling process, together with the leaching process and gas cavern conversion which will involve the use of the marine infrastructure components of the Proposed Development.

2.6.2 Drilling of the Wells

2.6.2.1 The drilling rig will operate 24 hours a day, 7 days a week until the well is drilled to the target salt layer. This is estimated to take approximately 60 days per well. The well cellars will be aligned in a single line across the wellhead area. A permanent below ground, open-topped concrete well cellar will be provided at each well head. This will provide support for the drilling rig and will house the wellhead equipment for the leaching work. The well cellars will also house the permanent wellhead equipment for the gas operations. The well cellars will be covered at ground level with a steel deck comprising open mesh.

2.6.2.2 The drilling rig will be erected on the drilling platform. The drilling rig will be lit during dark hours and will be provided with safety lighting. To support the leaching process, the drilling area will accommodate temporary infrastructure including:

- a leaching control building;
- a power and pump control building;
- a sea water balancing tank;
- brine discharge settlement tank;
- a nitrogen tank and compressor;
- high pressure cavern leaching pumps and all associated pipework;
- lay down and storage area; and
- work-over rig.

2.6.2.3 The work-over rig will be erected on the drilling platform. The work-over rig will be operational on average for two weeks a month during the leaching process, with some periods of more intense activity.

2.6.2.4 The typical sequence of drilling and casing installations for onshore salt caverns is as follows:

- Install and cement 30” conductor (depth ~38m);
- Directionally drill to ~600m and install / cement 20” surface casing;
- Continue directionally drilling to install / cement intermediate casing; and
- Drill to depth of salt and install / cement production casing.

2.6.3 Leaching of the Caverns

2.6.3.1 The caverns will be created by controlled leaching, also known as solution mining. This is an established technique used for extraction of salt and creation of gas storage caverns for over 30 years. The detailed cavern design will not be completed until later in the design process. The leaching of caverns will result in brine water being discharged to sea.

2.6.3.2 Once the well is drilled and the steel casings have been cemented inside the well, two concentric leaching strings will be inserted into each well, inside the casing. Two different 'leaching modes' can be applied:

- direct mode (bottom injection): injection through the inner leaching string; and
- reverse mode (top injection): injection through the annulus between inner and outer leaching string.

2.6.3.3 Using direct leaching as an example, abstracted sea water will be pumped down the inner string at high pressure to the salt layer where it will dissolve the salt and create brine. This brine will flow back up the annulus between the two strings and then be discharged to the sea via the outfall pipe and diffuser where it will be quickly diluted by the sea.

2.6.3.4 The leaching strings will be raised and lowered to control the shape of the cavern as it grows, and during different stages, the direction of flow may be reversed in the inner tube and the annulus (i.e. reverse mode). The annulus between the outer leaching tubing and the borehole casing/wall is filled with a 'blanket' to protect the cavern roof from dissolving. The water injection pressure will be determined by the difference in the density of seawater and brine (brine density increases through the leaching process as it becomes more saturated) and by the hydraulic friction losses in the leaching strings.

2.6.4 First Gas

2.6.4.1 A de-brining string will be installed inside the production tubing and hydrogen gas will be injected into the annulus between the de-brining string and production tubing. The hydrogen will be transported into the Proposed Development via a proposed hydrogen pipeline which is to be consented via a separate application. The gas pressure will be raised using compressors and used to force the brine out of the cavern and up the de-brining string. The brine will then flow through the brine discharge pipework and discharge to the sea through the diffuser. The maximum brine flow rates during the de-brining process will be 160 m^3hr^{-1} per cavern, with up to four caverns being de-brined at any one time.

2.6.4.2 It will take several months to remove the brine from the cavern and replace it with gas. It is not possible to remove all the brine as the cavern floor will be irregular and the bottom of the de-brining string must be positioned clear of the floor to prevent blockage.

2.6.4.3 Following the cavern construction, the 'tightness' of the cavern will be tested by performing a Mechanical Integrity Test (MIT) with nitrogen then hydrogen. The gas completion will then be installed and the caverns filled with hydrogen. If only one MIT can be carried out, it will be tested with hydrogen, since this has a slightly smaller molecular size than nitrogen and is also the desired storage medium.

2.6.4.4 A final sonar survey will be undertaken once the cavern is complete, however sonar surveys will also be taken over the lifetime of the cavern to confirm integrity of the cavern / roof and monitor convergence of salt (i.e. monitoring the asset through its life to ensure it is safe).

2.6.5 Brine Composition

2.6.5.1 The brine discharge will contain solids from the incoming seawater and the leachate from the caverns. A settling tank will be provided onshore to allow for the removal of the bulk of the solids. The specification of the brine discharge from the Proposed Development will be very similar to the discharge generated as part of AGS. The values for AGS were as follows:

- Typical density: 1178 kg/m^3
- Maximum density: 1217 kg/m^3

- Salt content: approx. 185-230 g/l
- pH: approx. 8.76
- Conductivity: approx. 51.5 mS/cm
- Suspended solids including marl, sand, grit, gypsum, stones.

2.7 Operation and Maintenance

2.7.1 Overview

2.7.1.1 The overall O&M strategy will be finalised once the final infrastructure technical specification is known. Maintenance activities will be categorised into two levels: preventive and corrective maintenance. Preventive maintenance will be undertaken according to scheduled services whereas corrective maintenance will be required to address unexpected repairs, component replacements, retrofit campaigns and breakdowns.

2.7.1.2 The operational processes will be the import and export of gas to meet market demands. The operational modes are described below:

2.7.2 Import Mode

2.7.2.1 When the hydrogen gas is imported, it will pass through import metering and manifold on entering the Hydrogen Storage Facility. Within the CPA, the gas will be compressed and cooled for injection into one or more of the caverns. The gas in each of the caverns will be stored at a downhole pressure of up to 295 barg and at a typical temperature of 50°C however this could be up to 65^{o}C.

2.7.3 Export Mode

2.7.3.1 Hydrogen gas will be exported from the caverns to a wider gas network. The saturated gas withdrawn from the caverns will be filtered, de-pressurised, dried and cooled within the withdrawal train and exported via the manifold and export metering. The Hydrogen Storage Facility is expected to typically operate in either import or export mode but will be capable of operating in either mode simultaneously in normal operations. The Hydrogen Storage Facility will have the ability for inter-cavern gas transfer.

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

2.8 Decommissioning

2.8.1.1 The design life of the subsurface infrastructure (i.e. caverns and wells) will be in excess of the design life of the surface facilities. This will ensure sufficient life to allow end of life management of the wells and caverns i.e. suspension and abandonment. The design life of the above ground infrastructure (CPA and wellhead area) is expected to be 30 years. The design life of the seawater facilities is expected to be 10 years to permit leaching activities however such facilities will not be required to support decommissioning.

2.8.1.2 The decommissioning sequence is expected to require six months for rewatering of the caverns, five years for monitoring and 40 days for well plugging. It will generally be the reverse of the construction sequence, involving similar types and numbers of vessels and equipment. The decommissioning plan and programme will be developed prior to

construction and be updated during the Proposed Development's lifespan to take account of changing best-practice and new technologies. However, the decommissioning process is anticipated to involve the following:

- rewatering of the caverns with water from an on-site groundwater abstraction well to displace the hydrogen gas;
- confirm that the cavern is in a safe state before being permanently abandoned;
- removal of surface equipment once the caverns and wells are abandoned;
- reinstatement of the storage site to a suitable condition;
- closure of the facility in accordance with environmental permitting process outlined in Section 3.3.2 to avoid contamination of soils and waters and the role of the Site Condition Report; and
- removal of the marine infrastructure protruding above the seabed.

2.9 Employment

2.9.1.1 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 an average 200 jobs during construction and 50 permanent jobs during operation. There will be economic benefits arising from direct and indirect expenditure associated with the Proposed Development, for example through placing local orders for goods and services and maintenance.

3. PLANNING AND POLICY CONTEXT

3.1 Planning Consents and EIA

3.1.1 The Planning Act 2008

3.1.1.1 The Planning Act 2008 (as amended) is the primary piece of legislation that establishes the legal framework for the application, examination, and determination of applications for Nationally Significant Infrastructure Projects (NSIPs). It sets out the consenting system for all NSIPs, including those in the energy sector.

3.1.1.2 Part 2 of the Act specifies the provisions in relation to National Policy Statements (NPSs), which set the framework for decisions by the SoS. The NPSs also identify relevant environmental considerations. The NPSs, relevant to the Proposed Development are: NPS for Overarching Energy (EN-1), and NPS for Oil and Gas Supply and Storage (EN-4). The NPSs will remain in force in its entirety unless withdrawn or suspended in whole or in part by the SoS. They are subject to review by the SoS in order to ensure that they remain appropriate.

3.1.1.3 In accordance with Section 14, 1 (c) development relating to underground gas storage facilities and Section 17, the Proposed Development is defined as an NSIP, for which a DCO is required.

3.1.1.4 Section 17 (1) provides that development relating to underground gas storage facilities is within section 14(1)(c) only if the development is within subsection (2), (3) or (5). The Proposed Development falls within section 17(2) as it is the carrying out of operations for the purpose of creating underground gas storage facilities in England and the conditions in subsection (4) are met. The conditions in section 17(4) are that:

- the working capacity of the facilities is expected to be at least 43 million Sm3, or
- the maximum flow rate of the facilities is expected to be at least 4.5 million Sm3 per day.

3.1.1.5 The Proposed Development will meet both of these conditions.

3.1.1.6 Amendments have been made to the planning system that are applicable to the Planning Act 2008, through the Localism Act 2011. Under the Localism Act 2011, the Planning Inspectorate became the executive agency responsible for the NSIP planning process. Any developer wishing to construct a project that is classified as an NSIP must apply for development consent. The Planning Inspectorate will examine the application submissions and make a recommendation to the relevant SoS, in this case the SoS for Department for Energy Security and Net Zero (DESNZ), to grant a DCO or refuse consent.

3.1.2 The DCO and ES

3.1.2.1 Section 31 of the Planning Act 2008 states that a DCO is required for all development that is, or forms part of, an NSIP. Insofar as a project benefits from a DCO, the following is not required:

- planning permission under the Town and Country Planning Act 1990;
- consent under section 36 or 37 of the Electricity Act 1989 (which relates to the construction of an onshore generating station and overhead lines);
- listed building and conservation area consent under Sections 7(1) and 74(1) of the Planning (Listed Buildings and Conservation Areas) Act 1990;
- scheduled monument consent under Section 2(3) or 3 of the Ancient Monuments and Archaeological Areas Act 1979;

- the erection of buildings and the construction of sewer main pipes, watercourses and electric lines on Green Belt land under Sections 10(1), 11(1) or 12(1) of the Green Belt (London and Home Counties) Act 1938;
- pipe-line construction authorisation for the construction of a cross-country pipe-line (i.e., a pipe-line over 16.093km long) under Section 1(1) of the Pipe-lines Act 1962;
- storage authorisation order for the storage of gas in natural porous underground strata under Section 4(1) of the Gas Act 1965; and
- notice required of operations in areas of archaeological importance under Section 35(1) of the Ancient Monuments and Archaeological Areas Act 1979.

3.1.2.2 The DCO will authorise the Proposed Development in its entirety (i.e. both the offshore and the onshore aspects of the Proposed Development). In addition to the principal consents for the Proposed Development, any additional consents and licences will be identified during the development stage and through consultations with statutory bodies.

3.1.2.3 A formal EIA will be required as part of the application for a DCO. An ES will be prepared, which is the formal report documenting the EIA process. The ES will be prepared in accordance with the 2017 EIA Regulations. These Regulations implement Directive 2011/92/EU, as amended by Directive 2014/52/EU, of the European Parliament ('the EIA Directive') for consent applications made under the Planning Act 2008. The aim of the EIA Directive is to ensure that when a relevant authority giving consent for a particular project makes its decision, it does so in the knowledge of any likely significant effects on the environment.

3.1.3 Marine and Coastal Access Act (MCAA) 2009

3.1.3.1 The MCAA 2009 introduced a spatial planning system for marine environmental management and a requirement to obtain 'Marine Licences' for works at sea.

3.1.3.2 The MCAA inserted Section 149A into the Planning Act 2008 which enables an applicant for a DCO to apply for Marine Licences to be deemed as granted as part of the DCO process. The Marine Management Organisation (MMO) is the responsible authority for licensing under the MCAA and is thus a key stakeholder where deemed Marine Licences are included in the DCO. The MMO remains the monitoring and enforcement body in respect of the conditions and restrictions set out in the deemed Marine Licences. It is the Applicant's intention to seek a deemed Marine Licence as part of the DCO application.

3.1.4 Hazardous Substances Consent

3.1.4.1 Section 12(2B) of the Planning (Hazardous Substances) Act 1990 provides that hazardous substance consent can be deemed as granted by a DCO. Hazardous substance consent is required for the storage of more than two tonnes of hydrogen. Currently, it is not the Applicant's intention to seek a deemed hazardous substance consent as part of the DCO application.

3.2 The Application and Consenting Process

3.2.1 The Development Consent Order Process

3.2.1.1 The DCO will authorise statutory consent for the Proposed Development. The process for obtaining a DCO is split into the following phases: pre-application, acceptance, pre-examination, examination, decision and post decision.

3.2.1.2 During the pre-application phase, Part 5 of the Planning Act 2008 requires promoters of a DCO application to engage in pre-application consultation with local communities, local authorities and those who would be directly affected by the proposals, including those with

an interest in the land. The 2017 EIA Regulations make provisions for various matters in connection with making an application for Development Consent, including publicising a proposed application and consulting with local and statutory stakeholders and those with an interest in the land.

3.2.1.3 The Proposed Development application will be submitted to the Planning Inspectorate with the prescribed forms and documents as required by the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009. Regulation 5(2)(a) requires that, where applicable, an application must be accompanied by "*the environmental statement required pursuant to the Infrastructure Planning (Environmental Impact Assessment) Regulations [2017] and any scoping or screening opinions or directions*". A number of other supporting documents are also required to be submitted, including:

- a Consultation Report;
- a Draft DCO, including draft requirements to secure identified mitigation as required through the EIA process, and Explanatory Memorandum; and
- a Habitat Regulations Assessment (HRA) Report (see **Section 3.2.3**).

3.2.2 The EIA Process

3.2.2.1 The EIA Directive requires an EIA to be completed in support of a DCO for certain types of projects. Hydrogen storage facilities are listed in Annex II of the EIA Directive, as "*underground storage of combustible gases*".

3.2.2.2 In the UK, the EIA Directive is applied through the 2017 EIA Regulations. These Regulations set out the statutory process and minimum requirements for the provision of adequate environmental information to enable the EIA process. The EIA, activities, surveys, and studies will be reported in the Proposed Development ES.

3.2.2.3 The EIA process can be broadly summarised as consisting of three main elements that take place prior to the submission of the DCO and ES:

- **Scoping:** project promoters can request a formal Scoping Opinion from the Planning Inspectorate (this document is the Scoping Report to support that request).
- **Consultation**: the project promoter is required to conduct pre-application consultation in accordance with the Planning Act 2008 plus associated guidance and regulations, which includes the 2017 EIA Regulations. A PEIR will be prepared and employed during the consultation process.
- **ES Preparation:** the ES is prepared considering the responses throughout the staged consultation process.

3.2.3 Habitats Regulations Assessment

3.2.3.1 The Conservation of Habitats and Species Regulations 2017 (‘Habitats Regulations’) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (‘Offshore Habitat Regulations’) require an appropriate assessment of any adverse effects on qualifying features of internationally important nature conservation sites that are likely to be significantly affected by a proposed project. These internationally important sites include Special Areas of Conservation (SACs), or candidate SACs (cSACs), Special Protection Areas (SPAs) or potential SPAs (pSPAs), Sites of Community Importance (SCIs) and Ramsar sites. These are often referred to as ‘European Conservation Sites’. This assessment is to be undertaken by the 'competent authority', which in the case of the Proposed Development is the SoS for DESNZ.

3.2.3.2 In order to carry out the HRA, the competent authority, under Regulation 5(2)(g) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, requires a report to be submitted alongside the ES. As such, the HRA does not form part of the ES, although the baseline presented contains some of the same information.

3.3 Planning and Consenting Context

3.3.1 Overview

3.3.1.1 A review of planning applications associated with AGS Extension are summarised below in Table .

Table 3.1: Site Planning History

Planning Reference	Description	Comment
06/09372/STPLFE	Extension to existing gas storage facility - solution mining of nine underground natural gas storage caverns and associated infrastructure and landscaping	Application Approved (30.10.2007)
07/31952/CONDET	Submission of details for Conditions 2, 3 (a), (b), (c), (d), (e), (f), (g), (i), (j), (k), 4, 6, 8, 9,10, 12, 13, 16, 19,20, 21, 22 and works associated with site preparation of the CPA and wellhead of Planning Approval DC/06/09372/STPLFE	Application Approved (21.02.2008)
08/31392/CONDET	Submission of amended details in relation to condition no 3(C) of planning permission 06/09372/STPLFE relating to Layout, Design and External Appearance and dimensions of Structures.	Application Approved (23.12.2008)
08/30461/CONDET	Submission of details for Condition 34 works associated with site preparation of the CPA and wellhead of Planning Approval ref. 06/09372/STPLFE	Application Approved (18.03.2008)
09/30580/CONDET	Submission of details relating to condition 26 (Reinstatement Scheme) of Planning Permission 06/09372/STPLFE	Finally Disposed of (22.09.2016)
09/30262/CONDET	Submission of details (proposal for relocation of the Water Bath Heaters) in relation to condition no 3(C) of planning permission 06/09372/STPLFE relating to Layout, Design and External Appearance and dimensions of Structures.	Application Approved (08.05.2009)
10/30714/CONDET	Submission of details required by planning permission 06/09372/STPLFE	Application Approved (06.01.2011)
12/00570/STPLFE	Relocation of wellhead platform, installation of underground leaching pipework, electrical control cabin, underground gas pipework and construction of new site entrance and access road from B1242 to wellhead platform, construction of temporary access roads and contractors' compound for above works (originally approved under 06/09372/STPLFE)	Application Approved (26.09.2013)
17/00574/STVARE	Removal of Condition 26 (re-instatement of land) of planning permission 12/00570/STPLFE (amendments to extension to existing gas storage facility) for retention of new site entrance and access road from B1242, tree planting and earthworks	Application Withdrawn (04.09.2020)

Planning Reference	Description	Comment
20/30307/CONDET	Submission of details required by Condition 6 (landscaping) of planning permission 12/00570/STPLFE	Application Approved (28.01.2021)

3.3.2 Environmental Permits, Consents and Licenses

3.3.2.1 The Environment Agency (EA) is responsible for the regulatory, licensing and advisory powers and duties derived from key Acts and Regulations, in particular the Environmental Permitting (England and Wales) Regulations 2016. The EA's environmental permits/licences cover:

- installations (industry regulation), including Medium Combustion Plant;
- waste management (waste treatment, recovery or disposal operations);
- discharges to controlled waters (surface, groundwater and marine);
- water abstraction or impounding licence;
- flood risk activities (for example - placing structures in, under or over a main river and development close to main rivers and flood defences); and
- radioactive substances activities.

3.3.2.2 Both the construction and operational phases of the Proposed Development may require one or more permits from the EA (that are not covered under planning requirements). The Proposed Development team will consult with the respective parts of the EA to confirm which permits may be required and to initiate the application process at appropriate points in the programme. Both environmental permits and abstraction licences can be exempted by a DCO pursuant to Section 150(1) of the Planning Act 2008, however this is currently not the Applicant's intention to seek that they be exempted.

3.3.2.3 Other consents that may be required for the Proposed Development, and which can be exempted through the DCO process, including for example the following:

- Pipeline works authorisation for the construction of pipelines for seawater abstraction and discharge of brine – Regulatory Authority: North Sea Transition Authority;
- Badger Licence – Regulatory Authority: Natural England;
- Wildlife Licence – Regulatory Authority: Natural England; and
- Ordinary Watercourse Consent – Regulatory Authority: East Riding of Yorkshire Council as Lead Local Flood Authority.

3.4 Policy Context

3.4.1 Introduction

3.4.1.1 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 chapter of the Scoping Report aims to identify the relevant policies so that the policy context is clear and provides the context for the Scoping Opinion.

3.4.1.2 The area identified within this report, and for the location of the Proposed Development site, is covered by the East Riding of Yorkshire Council (ERYC) as the Local Planning Authority (LPA). This planning chapter also reviews the planning policy of the LPA relevant to the Proposed Development.

3.4.2 National Policy

Existing National Policy

3.4.2.1 In July 2011 the UK government adopted a suite of NPSs that apply to NSIPs, including Overarching NPS for Energy (EN-1) and NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4).

Overarching NPS for Energy (EN-1) (July 2011)

3.4.2.2 EN-1 provides overarching national policy support for energy infrastructure. As a nascent technology at the time, hydrogen is not specifically referenced in EN-1, however paragraph 1.4.2 confirms that EN-1, in conjunction with EN-4, will be the primary basis for decision making for underground gas storage facilities that surpass the thresholds set out in section 17(4) of the Planning Act 2008.

NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (July 2011)

3.4.2.3 EN-4 provides national policy support for gas supply infrastructure and gas and oil pipelines. Like EN-1, EN-4 does not directly address hydrogen but does confirm that EN-4 applies to underground gas storage facilities which surpass the thresholds set out in section 17(4) of the Planning Act 2008.

Prospective National Policy

3.4.2.4 Both EN-1 and EN-4 were reissued in draft form in September 2021 and in March 2023 and are currently issued for public consultation (“Draft EN-1” and “Draft EN-4”). Draft EN-1 and Draft EN-4 have been updated to directly address recent technologies including low carbon hydrogen projects.

Draft Overarching NPS for Energy (EN-1) (March 2023)

3.4.2.5 Paragraph 3.3.58 confirms that the need for low carbon hydrogen infrastructure is established by Draft EN-1 and is urgent. Section 3.4 of Draft EN-1 establishes the need for low carbon hydrogen infrastructure, and states at paragraph 3.4.4 that the UK requires a diverse mix of hydrogen supply infrastructure including pipelines, storage and reception facilities in order to meet its energy objectives.

3.4.2.6 Paragraph 3.4.12 states that there is an urgent need for all types of low carbon hydrogen infrastructure to allow hydrogen to play its role in the transition to net zero, with the government confirming at paragraph 3.4.15 that it supports a twin track approach of developing both green and blue hydrogen production which will be needed to achieve the scale of low carbon hydrogen production required for net zero.

3.4.2.7 Paragraph 3.4.14 repeats the government’s ambition, first articulated in the British Energy Security Strategy, to deliver up to 10GW of low carbon hydrogen production capacity by 2030, subject to affordability and value for money.

3.4.2.8 Paragraph 3.4.19 recognises the critical enabling role that hydrogen transportation and storage (T&S) infrastructure will need to play in connecting hydrogen producers with consumers and balance misalignment in supply and demand, something which is also recognised in the UK government’s Hydrogen Strategy.

Draft NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (March 2023)

3.4.2.9 Paragraph 1.6.4 confirms that underground hydrogen storage facilities which surpass the thresholds set out in section 17(4) of the Planning Act 2008 constitute an NSIP and will require development consent from the SoS. Paragraph 1.6.6 confirms that the remainder of EN-4 has effect only in relation to natural gas (and not hydrogen) infrastructure but that it may contain information that is important and relevant to the SoS's decision on applications for hydrogen infrastructure.

3.4.2.10 The government's consultation on Draft EN-1 and Draft EN-4 runs until 11:45pm on 25 May 2023. Subject to the consultation responses received, it is anticipated that Draft EN-1 and Draft EN-4 will be adopted as national policy by Spring 2024. The updates to both documents indicate the general direction of travel in government policy and the considerable policy support which the government places behind the need to develop all kinds of low carbon hydrogen infrastructure.

3.4.2.11 It is expected that at the time the application is made an NPS will have effect. As such, the Project will fall under section 104 of the Planning Act 2008 which requires the SoS to have regard to any NPS which has effect in relation to the Proposed Development. Section 104 also requires the SoS to have regard to appropriate marine policy documents determined in accordance with Section 59 of the Marine Coastal Act 2009. In addition, the SoS must also take into account any local impact report, any matters prescribed in relation to the Proposed Development and any other matters the SoS thinks are both important and relevant to the decision.

3.4.2.12 The SoS must decide the application in accordance with any relevant NPS, except if one or more of four circumstances apply, namely, if deciding the application in accordance with a relevant NPS would:

- breach international obligations;
- breach any duty imposed on the SoS;
- be unlawful or;
- is satisfied that the adverse impact of the proposed development would outweigh its benefits.

NPS Assessment Principles and Impacts

3.4.2.13 The NPSs (both existing and prospective) contain sections on generic and technology specific assessment principles and potential impacts which will guide applications and decision making by the SoS. The Applicant has had due regard to the relevant assessment principles and guidance on impacts (both existing and prospective) in preparing this Scoping Report and will continue to do so in developing the Proposed Development and the application.

Overarching NPS for Energy (EN-1) (July 2011)

'Assessment Principles'

3.4.2.14 NPS EN1, Part 4, sets out the Assessment Principles and certain general policies with which applications relating to energy infrastructure shall accord. It states that the start should be a presumption in favour of granting consent for energy NSIPs given the level and urgency of need for infrastructure of these types.

3.4.2.15 The policy states that 'In considering any proposed development, and in particular when weighing its adverse impacts against its benefits, the IPC (now SoS) should take into account:

- Its potential benefits including contribution to meeting the need for energy infrastructure, job creation and any long term or wider benefits; and
- Its potential adverse, including any long term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.'

3.4.2.16 Therefore, the general assessment principles of the NPS requires that environmental, social and economic benefits and adverse impacts, at national, regional and local levels should be considered when assessing a proposed development.

3.4.2.17 Others matters that may be considered relevant and important to decision-making may include Development Plan Documents or other documents in the Local Development Framework. However, in the event of a conflict, the NPS would prevail for purposes of making a decision given the national significance of the infrastructure.

'Marine Considerations'

3.4.2.18 As stated in Section 104(2) of the Planning Act in assessing NSIPs, regard must be given to the Marine Policy Statement (MPS) and any applicable Marine Plan when exercising any function capable of affecting the whole or any part of the UK marine area. In the event of a conflict between any of these marine planning documents and an NPS, the NPS prevails for the purposes of decision making given the national significance of the infrastructure.

3.4.2.19 In paragraph 4.10.4, the NPS recommends early consultation with the MMO where any project has the potential to have an impact on any marine ecology, biodiversity, protected sites and general coastal environments.

3.4.2.20 A DCO decision may include a deemed marine licence and the MMO will advise on what conditions should apply to the deemed marine licence. The SoS and the MMO are encouraged by the NPS to cooperate closely to ensure that energy NSIPs are licensed in accordance with environmental legislation, including European directives.

'Climate Change Adaption'

3.4.2.21 Section 4.8 of the NPS details how applicants and determining bodies should take the effects of climate change into account when developing and consenting infrastructure. It states in paragraph 4.8.1 "*If new energy infrastructure is not sufficiently resilient against possible impacts of climate change, it will not be able to satisfy the energy needs as outlined in the NPS*."

3.4.2.22 It further states in paragraph 4.8.5 that 'applicants must consider the impacts of climate change when planning the location, design, build operation and, where appropriate decommissioning of new energy infrastructure. The ES should set out how the proposal will take into account of the projected impacts of climate change.'

'Criteria for "good design" for energy infrastructure'

3.4.2.23 Paragraph 4.5.1 states: 'The visual appearance of a building is sometimes considered to be the most important factor in good design. But high quality and inclusive design goes far beyond aesthetic considerations. The functionality of an object — be it a building or other type of infrastructure — including fitness for purpose and sustainability, is equally important. Applying "good design" to energy projects should produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible. It is acknowledged, however that the nature of much energy infrastructure development will often limit the extent to which it can contribute to the enhancement of the quality of the area.'

'Generic Impacts'

3.4.2.24 Section 5 of the adopted NPS, in common with the emerging draft NPD above, considers impacts that can arise from energy projects, which need to be considered as part of a development proposal, specifically air quality and emissions (5.2), biodiversity and geological conservation (5.3), civil and military aviation and defence interests (5.4), coastal change (5.5), dust, odour artificial light, smoke, steam and insect infestation (5.6), flood risk (5.7), historic environment (5.8), landscape and visual (5.9), land use, including open space, green infrastructure, and green belt (5.10), noise and vibration (5.11), socio-economic impacts (5.12), traffic and transport (5.13), waste management (5.14), water quality and resources (5.15), (with the notable exception of greenhouse gas emissions, which is now covered in the emerging draft NPS EN1 quoted above).

Draft Overarching NPS for Energy EN-1 (March 2023)

'Assessment Principles'

3.4.2.25 In terms of Assessment Principles to be applied to the determination of NSIP applications for energy, paragraph 4.1.3 states: '*In considering any proposed development, in particular when weighing its adverse impacts against its benefits, the Secretary of State should take into account: its potential benefits including its contribution to meeting the need for energy infrastructure, job creation, ecological enhancements, and any long-term or wider benefits, its potential adverse impacts, including any long-term and cumulative adverse impacts, as well as any measures to avoid, reduce, mitigate or compensate for any adverse impacts*.'

'Marine Considerations'

3.4.2.26 Paragraph 4.4.4 confirms that 'In making a decision, the SoS is responsible for determining how the Marine Plan informs the decision-making process. For example, the SoS will determine if and how proposals meet the high-level marine objectives, plan vision, and all relevant policies. In the event of a conflict between an NPS and any marine planning documents, the NPS prevails for purposes of decision making.'

'Climate Change Adaption'

3.4.2.27 Paragraph 4.9.2 confirms the Government's view that 'Renewable and low carbon development is an adaptive measure to address climate change.'

Criteria for "good design" for energy infrastructure

3.4.2.28 Paragraph 4.6.1 states, similarly to the existing EN1 NPS, that 'Applying "good design" to energy projects should produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible. It is acknowledged, however that the nature of much energy infrastructure development will often limit the extent to which it can contribute to the enhancement of the quality of the area.'

3.4.2.29 Paragraph 4.6.3 continues and states that ', *the Secretary of State needs to be satisfied that energy infrastructure developments are sustainable and, having regard to regulatory and other constraints, are as attractive, durable, and adaptable (including taking account of natural hazards such as flooding) as they can be*.'

3.4.2.30 In considering applications the function and purpose of the infrastructure should be taken into account, whilst bearing in mind the operational, safety and security requirements which the design has to satisfy, which ultimately will influence the design of the infrastructure.

'Generic Impacts'

3.4.2.31 Section 5 of the draft NPS considers impacts that can arise from energy projects, which need to be considered as part of a development proposal, specifically air quality and emissions (5.2), greenhouse gas emissions (5.3), biodiversity and geological conservation (5.4), civil and military aviation and defence interests (5.5), coastal change (5.6), dust, odour, artificial light, smoke, steam and insect infestation (5.7), flood risk (5.8), historic environment (5.9), landscape and visual (5.10), land use, including open space, green infrastructure, and green belt (5.11), noise and vibration (5.12), socio-economic impacts (5.13), traffic and transport (5.14), resource and waste management (5.15) and water quality and resources (5.16).

NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (July 2011)

'Underground Natural Gas Storage'

3.4.2.32 This NPS does not cover hydrogen development, being concerned only with gas (including Liquified Natural Gas (LNG) and oil, including storage. The NPS does however address the use of salt caverns for the storage of gas, indicating the use of salt caverns for the storage of gases is considered acceptable in principle by the Government, particularly in the north. Paragraph 2.8.7 states: '*Natural gas can also be stored in man-made salt caverns. In some areas, Britain has salt present in strata which are, or could be, suitable for gas storage. The most extensive areas, where suitably thick natural layers of salt are found, are in northern England and in smaller areas further south*.'

3.4.2.33 Paragraph 2.8.9 requires applicants to undertake 'a detailed geological assessment to demonstrate the suitability of the geology at the site for the type of underground gas storage proposed. When considering storage in porous rock, in a depleted or partially depleted oil or gas field, or in an aquifer, applicants should undertake a detailed geological assessment to determine the suitability of the rocks for underground gas storage. When considering storage in a salt cavern, the geological assessment should include depth below surface, salt thickness, salt purity and presence of shale bands which could affect cavern design. In addition, a study of the geological integrity of the overlying strata and potential for collapse, taking account of the proposed minimum and maximum working pressures, will need to be undertaken. The assessments should include the construction, operational and decommissioning phases and should cover the long-term integrity of the affected strata after decommissioning or closure of the storage facility. The IPC (now SoS) will consider the geological assessment alongside the environmental assessment if the former does not form part of the ES.'

'Underground Natural Gas Storage Impacts: Disposal of Brine'

3.4.2.34 Paragraph 2.11.1 states: '*Been formed and then the brine is withdrawn through the same well bore. Where associated pipelines are required to carry brine, these should be part of the application. The issue is the disposal of the brine*.'

3.4.2.35 Paragraph 2.11.2 states: '*The ES should include measures to dispose of brine which mitigate its potential adverse environmental effects*.'

3.4.2.36 This NPS mirrors requirements on applicants that are reflected in adopted and draft versions of NPS EN-1, particularly in the need to address environmental impacts.

Draft NPS for Gas Supply Infrastructure and Gas and Oil Pipelines EN-4 (March 2023)

'Background'

3.4.2.37 The Draft EN-4 includes references to hydrogen, where the current EN-4 is silent. Paragraph 1.1.2 states '*Natural gas will also continue to be used in conjunction with carbon capture use and storage (CCUS) infrastructure to produce low carbon electricity and as a feedstock for clean hydrogen production. Clean hydrogen, and the infrastructure that supports it, will be needed to help transition our energy system to net zero by 2050, with the potential to help decarbonise vital UK industry sectors and provide flexible deployment across heat, power and transport*.'

'Infrastructure covered by this NPS'

3.4.2.38 Paragraph 1.6.4 acknowledges when consent is required for hydrogen pipeline and underground storage projects, as well as recognising that the need for low carbon hydrogen is established in EN-1.

3.4.2.39 The paragraph further states that the guidance in the NPS has been drafted in respect of, and has effect only in relation to, natural gas infrastructure, and that it does not have effect for hydrogen infrastructure. It may however contain information that is important and relevant to the SoS's decision on applications for hydrogen infrastructure.

3.4.2.40 It is anticipated that as the evidence base evolves, further guidance will be provided to allow timely implementation of policy relating to low carbon hydrogen and other necessary infrastructure.

'Underground Natural Gas Storage Impacts: Disposal of Brine'

3.4.2.41 Paragraph 2.11.2 states that '*The ES must include measures to dispose of brine which mitigate its potential adverse environmental effects. Where pipelines are required to carry the brine away, these should be located outside of source protection zones 1 and 2. If it is not possible to avoid these zones, the applicant will need to demonstrate the use of best available techniques for pollution prevention (details of pollution control regimes are set out in Section 4.11 of EN-1*).'

3.4.2.42 The NPS requires that here the proposed development involves any discharges to water bodies, including to groundwater or to the sea, applicants should contact the EA early in the process, at or before the pre-application consultation stage, to discuss the requirements (including the information required from the applicant).

3.4.2.43 Any measures to discharge brine into an underground reservoir or the sea, where either is an appropriate course of action, will need to be covered by environmental permits or discharge consents, and informed by discussions with the EA.

National Planning Policy Framework

3.4.2.44 The National Planning Policy Framework (NPPF) was last updated in July 2021 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.

3.4.2.45 The policies contained within the NPPF are expanded upon and supported by the 'Planning Practice Guidance'[5] .

[5] Ministry of Housing, Communities and Local Government, 2019b. Available online at: https://webarchive.nationalarchives.gov.uk/ukgwa/20210708211349/https://www.gov.uk/government/publications/national-planning-policy-framework--2.

3.4.2.46 The NPPF is a material consideration in planning decisions.

3.4.2.47 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.

3.4.2.48 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'.

3.4.2.49 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.'

3.4.2.50 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.

3.4.2.51 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.

3.4.2.52 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*.'

UK Marine Policy Statement

3.4.2.53 The MPS[6] facilitates and supports the formulation of 'Marine Plans', ensuring that marine resources are used in a sustainable way in line with the high-level marine objectives thereby:

- Promoting sustainable economic development;
- Enabling the UK's move towards a low-carbon economy, in order to mitigate the causes of climate change and ocean acidification and adapt to their effects;
- Ensuring a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and our heritage assets; and

[6] Department for Environment, Food and Rural Affairs, UK Marine Policy Statement. Available online at: https://www.gov.uk/government/publications/uk-marine-policy-statement.

- Contributing to the societal benefits of the marine area, including the sustainable use of marine resources to address local social and economic issues.

3.4.3 Regional Policy

3.4.3.1 The Proposed Development considered as part of this Scoping Report is located within the ERYC LPA jurisdiction.

3.4.3.2 There are policy documents that have been prepared between the two LPAs, and with other LPAs. In consideration of the Proposed Development location these joint policies are summarised below.

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

3.4.3.3 This framework document covers the York, North Yorkshire, East Riding and Hull (YNYERH) area 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.

3.4.3.4 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 LPA.

3.4.3.5 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 Proposed Development.

3.4.3.6 The Proposed Development 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 is promoted.

3.4.4 Local Policy

3.4.4.1 The statutory development plan for East Riding of Yorkshire LPA consists of the following documents:

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

3.4.4.2 Emerging planning policy:

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

East Riding Local Plan Strategy Document

3.4.4.3 The 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. It sets out a vision for the East Riding and includes a number of objectives for bringing forward sustainable development. The policies in the document aim to support growth whilst protecting those characteristics that make the East Riding special.

3.4.4.4 Policies relevant to the Proposed Development 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 A1: Beverley & Central sub area

Key Spatial Issues

3.4.4.5 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.

3.4.4.6 The majority of the polices within the Plan are relevant to the Proposed Development, 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.

Climate Change

3.4.4.7 As stated in Policy S2: Addressing climate change, the 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 [7], 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 & EC5 locations being the points the development would benefit in addressing the aims of Policy S2.

3.4.4.8 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 supports carbon capture and storage whilst stating that '*will be supported where any significant adverse impacts are addressed satisfactorily, and the residual harm is outweighed by the wider benefits of the proposal'*.

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

The Economy

3.4.4.9 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.

3.4.4.10 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.

3.4.4.11 Policy S6 further states in paragraph 5.23 that 'the Humber Local Enterprise 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'.

3.4.4.12 The site is identified in the Plan as a "Super Cluster", areas identified as suitable for the management and distribution of new renewable energy development.

3.4.4.13 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 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.

3.4.4.14 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 developments that positively contribute to employment sectors and clusters, including renewable energy, chemicals, and ports as stated in section A.

3.4.4.15 Policy A5: Holderness & 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.

Environment

3.4.4.16 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 detailing 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*".

3.4.4.17 Policy A5 section C further reiterates the importance to protect and safeguard the local environment whilst providing highly needed infrastructures within the area.

Biodiversity and Geodiversity

3.4.4.18 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.

3.4.4.19 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.

3.4.4.20 The Humber Estuary is a Ramsar site, a SPA, a SAC, and a Site of Special Scientific Interest (SSSI) is 12.4 km south-west of the Proposed Development which due to its international importance and mobile qualifying species (birds), is also considered in the scoping assessment and HRA. In addition, there is the Greater Wash SPA and Holderness Inshore Marine Conservation Zone (MCZ) within the Scoping Boundary, Lambwath Meadows SSSI 4.9 km to the north, Bail Wood Ancient Woodland and Local Wildlife Site (LWS) and Garton-Humbleton LWS 400 m south-west. 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.

3.4.4.21 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.

Managing Environmental Hazards

3.4.4.22 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 taken into account to address these potential issues when creating new and necessary infrastructure.

3.4.4.23 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’. Under guidelines set all new potential developments must not increase the risk of flooding.

3.4.4.24 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.

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

East Riding Local Plan 2012-2029 Allocations Document

3.4.4.26 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.

3.4.4.27 The site falls 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.

3.4.5 Emerging Policy

Local Plan Update

3.4.5.1 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 determined that an update is required to respond to:

- changes in the new National Planning Policy Framework
- 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.

3.4.5.2 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 SoS for examination.

3.4.5.3 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.

Economy

3.4.5.4 The draft Local Plan Update seeks to build on the importance of 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 maintains the same ideology in regard 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 UKs energy sector.

Energy and Low Carbon Sector

3.4.5.5 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 it the policy brings awareness to the importance in addressing the UKs 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".

Climate Change and Environment

3.4.5.6 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.

3.4.5.7 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.

3.4.5.8 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.

Draft Local Plan Allocations Document May 2021

3.4.5.9 As with the existing adopted Allocations document, the Proposed Development is not identified as a specific allocation within the document. The Site is not specifically allocated, 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*".

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

3.4.5.10 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).

3.4.5.11 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.

4. ALTERNATIVES

4.1 Introduction

4.1.1.1 Schedule 4 (paragraph 2) of the 2017 EIA Regulations require developers to outline how chosen options have been selected and the reasonable alternatives considered by the applicant. The ES will set out the options considered for the Proposed Development and the main reasons for selecting particular options, taking into consideration environmental effects, technical feasibility and the overall objectives of the project. In addition, the EIA will also consider a 'no development option' which will outline the likely evolution of the baseline scenario without implementation of the Proposed Development.

4.1.1.2 This chapter presents a summary of the process followed to date for the Hydrogen Storage Facility site selection and the Marine Infrastructure. The PEIR and ES will provide further detail on the selection processes including how the design and locations have evolved over time and any refinements that take place specifically as a result of the EIA process and in response to stakeholder feedback.

4.2 Hydrogen Storage Facility Site Selection

4.2.1.1 Hydrogen is one of the few abundant gases which has the capability to not only generate other forms of power, such as electricity, but to also decarbonise a wider array of industries, including:

- transportation;
- chemical processing;
- glass manufacturing; and
- steel manufacturing.

4.2.1.2 The Humber region is an optimal location to develop the Proposed Development, since the number of industrial off takers will grow when hydrogen is available in bulk and in an un-interruptible supply. Storage of hydrogen is a critical element in securing a consistent supply of hydrogen to off takers. The use of a storage location in close proximity to the generation of hydrogen and a distribution network increases efficiencies and allows for the rapid decarbonisation of the local area. This is a critical consideration for achieving Net Zero before 2050.

4.2.1.3 The nature of the geological deposits in the surrounding area is crucial for the successful delivery of an underground gas storage project. An evaluation of geological conditions for the Hydrogen Storage Facility has already been undertaken as part of the investigations carried out for AGS. This determined that the geology of the region is primarily Carboniferous to Cretaceous in age. 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, suitable for underground gas storage.

4.2.1.4 The development of AGS has provided geological understanding and site-specific experience which would not have been available should another site have been chosen. This will be supplemented with additional investigation and assessment for the Proposed Development.

4.2.1.5 Developing in close proximity to the existing AGS facility, will allow the opportunity of potential future expansion of hydrogen storage through the conversion of the existing natural gas caverns to hydrogen.

4.2.1.6 The use of solution mining as a way of excavating the storage caverns is a proven technology and has been utilised for AGS. This was also the method proposed for the previous AGS Extension project.

4.2.1.7 The specific layout for the Proposed Development is based on the AGS Extension and has been further optimised for the Proposed Development. The benefits of this proposed layout include the fact that the CPA, wellhead and leaching area are all within the existing landscaped areas created as part of AGS Extension. Whilst the AGS Extension did not proceed the trees that were planted to screen the development over 9 years ago have grown significantly. This will significantly reduce the visual impact of the Proposed Development to the surrounding receptors.

4.3 Marine Infrastructure

4.3.1.1 Initially, the existing leaching system located at AGS was considered for the purpose of solution mining and brine discharge, to reduce the impact to the environment (i.e. remove or reduce the need for marine disturbance due to construction). This leaching system was installed in 2005 for the purpose of solution mining the caverns for natural gas storage as part of AGS. However, the system has been subject to corrosion and wave loading for 18 years and the last cavern was completed in 2011. Given that the leaching system has not been used for 11 years, the overall condition was unknown.

4.3.1.2 A scope of works was therefore developed to engage with inspection companies and determine whether the condition of the leaching system would allow for refurbishment and recommissioning.

4.3.1.3 It was determined that the pipelines, both onshore and offshore, should be relined or replaced. Given the scale of the solution mining operations, a reduced pipe diameter resulting from relining would require the replacement of the existing pumps located offshore on a monopile with a more substantial pumping capacity. Further assessment determined that the monopile, a key component for the abstraction of seawater, had passed its fatigue design life and this structure would have to be replaced rather than refurbished. The refurbishment of the existing infrastructure was therefore discounted on the basis that it could not meet the requirements of the construction phase for the Proposed Development

4.3.1.4 A revised pumping system is therefore proposed that allows for a new system comprising the use of a gravity feed sea water system into a wet well and an onshore pumping solution.

4.3.1.5 This system has the benefit of limited visual impact since the majority of the infrastructure is below ground, with reduced noise and minimal impact on, and from, coastal processes compared to the existing system. It is therefore less disruptive to the marine environment in the long term.

4.3.1.6 In addition;

- The new design is safer to operate and maintain given that it is located onshore rather than offshore. This is a key consideration in the assessment of options and subsequent design.
- The new design is more resilient to the eroding coastline, noting that the existing pipelines are now visible as a result of erosion. The new design includes a wet well located 930 m away from the intake, with the onshore pipelines installed using HDD under the beach to prevent exposure.
- Simplicity of the structure results in a longer design life compared to the old system, thereby future proofing the system with limited visible above ground evidence of its presence. It is important to note that the leaching system is primarily required for the construction of the salt cavities but maybe required in the future for maintenance, such as rewatering of the cavities.

4.4 Scoping Boundary

4.4.1.1 The Scoping Boundary for the Proposed Development has been extended beyond the AGS Extension Planning Permission boundary since the location of the new caverns has not yet been finalised and will be the direct result of the ongoing design phase. The extent of the above ground infrastructure is presented is limited in area compared to the extent of the Scoping Boundary.

4.4.1.2 The Scoping Boundary was also extended further to the east to allow for the sea water abstraction and brine discharge infrastructure.

4.5 Refinement and Next Steps

4.5.1.1 The Scoping Boundary presented in this Scoping Report is a composite of the search areas adopted at this stage in design. As design, consultation and the EIA proceed, the areas will reduce.

5. EIA METHODOLOGY

5.1 Introduction

5.1.1.1 This chapter 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 **Chapters 6 to 8**.

5.2 EIA Regulations and Guidance

5.2.1.1 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.

5.2.1.2 The primary objective of an EIA is inscribed under Article 2 of the directive which states that "*Member States shall 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*."

5.2.1.3 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*".

5.2.1.4 The requirements of the EIA Directive for developments defined as a NSIP by the Planning Act 2008 are written into UK law through the 2017 EIA Regulations. These regulations set out the statutory process and minimum requirements for the provision of adequate environmental information to enable the EIA process. The Scoping Report is provided in accordance with Regulation 10 of the 2017 EIA Regulations.

5.2.1.5 Regulation 14 and Schedule 4 specify the information that must be included in an ES. The ES will report the findings of the EIA and its supporting activities including survey findings, modelling outputs, and additional studies.

5.2.1.6 In practical terms, the purpose of the EIA documentation is to inform the Planning Inspectorate (who will examine the application and make a recommendation to the SoS 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.

5.2.1.7 As such, the likely significant effects of the Proposed Development will be identified for each relevant EIA topic. This will be achieved by comparing baseline environmental conditions (i.e. the situation without the Proposed Development) with the conditions that would prevail were the Proposed Development 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.

5.2.1.8 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).

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

- NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4);
- Guidelines for Environmental Impact Assessment, Institute of Environmental Management and Assessment (IEMA), 2004;
- Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements Version 7,2020;
- Guide to Shaping Quality Development, IEMA 2015; and
- Delivering Proportionate EIA, A Collaborative Strategy for Enhancing UK Environmental Impact Assessment Practice, IEMA 2017.

5.3 Baseline for the EIA

5.3.1.1 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; and
- 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.

5.3.1.2 **Chapters 6 to 8** describe the data sources to be used and the baseline studies that will be undertaken for the EIA.

5.4 Identification and Assessment of Effects

5.4.1.1 Figure 5.1 sets out the general approach to the assessment of likely significant effects that may arise from the Proposed Development.

5.4.1.2 Whilst Figure 5.1 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. **Chapters 6 to 8** outline the proposed approaches to the technical topics that will be addressed in the EIA.

5.4.1.3 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 30 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.

5.4.1.4 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.

5.4.1.5 The approach to this Scoping Report has been to initially consider the Hydrogen Storage Facility and the Marine Infrastructure (where relevant) separately in the first part of each

topic section. Although the Scoping Report has been structured in this way, the conclusions drawn for each of the topic assessments will be based on the Proposed Development as a whole (to the extent this is necessary).

5.4.1.6 Where inter-relationships exist between different aspects of the environmental and socio-economic setting for the Proposed Development, 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, human health and air quality;
- the value of a feature of cultural heritage being related to its setting (e.g. visual and noise environments); and
- emissions to atmosphere and effects on habitats from the deposition of pollutants.

5.4.1.7 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.

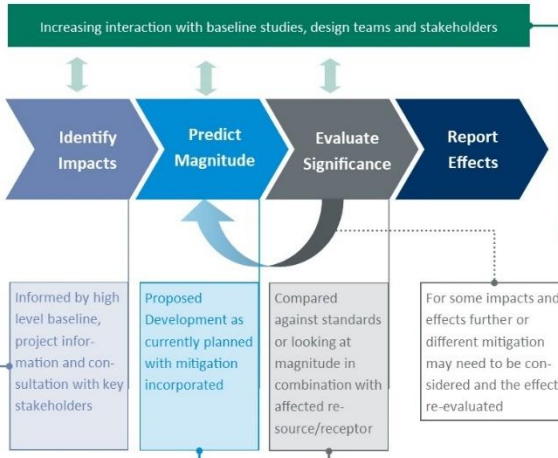
5.4.1.8 There is no widely accepted definition of ‘indirect’ effects; the term is often used interchangeably with ‘secondary’ effects. However, the 2017 EIA Regulations do distinguish between the two terms. For the purposes of this EIA, ‘secondary’ (and higher order) effects are taken to be part of a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

Figure 5.1 EIA Methodology Overview

Identify Impact
The scoping process identified the potentially most important/significant impacts and effects (including secondary, indirect and cumulative) for the assessment to address. This was done through a combination of:

- looking at the nature of the Proposed Development activities and the impacts they will give rise to;
- looking at the Proposed Development's environmental and social setting and those aspects which are likely to be most sensitive/vulnerable to impacts from the Proposed Development;
- applying professional understanding gained from the evidence base; and
- incorporating inputs from stakeholders through the Scoping Opinion and public consultation.

Decisions were made on which impacts and effects to assess or to prioritise in the assessment (scoping in and scoping out) and how to assess them (proposed methodology, qualitative versus quantitative assessment).



Describe Baseline
Baseline data will be collected to better understand the potentially most important impacts and effects identified in scoping. Baseline data will quantify existing exposure levels (e.g. for noise, air and water pollution), identify vulnerable populations of animals or people's livelihoods, more clearly delineate valued cultural property and ecosystem services etc.

Where a baseline aspect cannot be quantified then nominal levels of importance, quality or value (low, medium, high) will be assigned based on widely accepted criteria in fields such as ecology, cultural heritage, landscape and socioeconomic assessment. Inter-relationships between elements of the baseline will be identified.

Interact with Proposed Development Design
The EIA process will interact with the Proposed Development design teams to develop a basis for the assessment (for example quantities of emissions, noise levels of equipment, sizes of structures). The EIA process will also interact with design to assess optimal mitigation measures, especially when after initial assessment some impacts need to be further reduced.

Consult Stakeholders
Ongoing stakeholder consultation, is good practice in EIA and will be undertaken to: present preliminary findings to stakeholders to elicit early responses; refine the assessment; and help make the ES as fit for purpose as possible.

Predict Magnitude
The Proposed Development's impacts will be quantified in terms of such matters as:

- area of habitat loss;
- proportion of an ecological population exposed to impact;
- change in noise levels or pollution at a receptor; and
- construction traffic pressures on the local highways.

In predicting magnitude, the effect of all the mitigation in place (i.e. adopted by the Proposed Development) will be taken into account.

For some impacts, especially noise, air and water pollution, significance will be assessed directly against numerical criteria and standards. For exceedances, further mitigation will be incorporated by the Proposed Development to reduce the magnitude of the impact (and the significance of its effect).

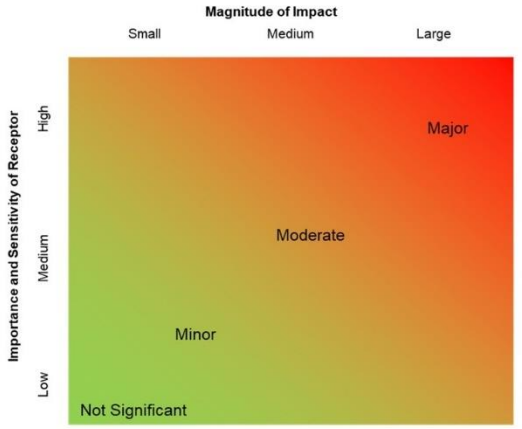
For other impacts nominal levels of magnitude (e.g. small, medium, large) will be adopted based on widely recognised factors such as: the nature of a change; its size, scale or intensity; its geographical extent and distribution; its duration, frequency, reversibility and, for unplanned events, its likelihood of occurrence .

Some activities will result in changes to the environment that may be immeasurable or undetectable or within the range of normal natural variation. Such changes will be assessed as having no impact or to be of negligible magnitude and not leading to significant effects.

Evaluate Significance
In evaluating significance, the EIA process will seek to inform regulators and stakeholders about the effects of the Proposed Development in a way that helps them make decisions on whether to approve and allows them to develop suitable conditions to attach to an approval. The evaluation of significance will ideally demonstrate legal compliance at least (e.g. compliance with quantified standards, avoidance of effects on legally protected resources).

In the absence of quantified standards, significance will be evaluated through considering the magnitude of an impact in combination with the importance/quality/value of the receptor or resource that is affected, also considering the response (or sensitivity) of a resource or a receptor to a particular impact. Effects of more than minor significance will be re-examined to see if an impact magnitude can be reduced further. Different mitigation options will be examined and the reasons for selecting one and rejecting others explained where appropriate. Some impacts/effects that cannot be adequately mitigated will be addressed through the consideration of offsets or compensation.

In some instances, the evaluation process will go through one or more iterations of working with the Proposed Development design to develop suitable mitigation measures and re-evaluating impacts and effects. The ES will report the significance of the residual effects, with all the mitigation committed to by the Proposed Development fully taken into consideration.



While the above 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.

5.4.1.9 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 Proposed Development 'indirect effects' falling within this definition are proposed to be scoped out.

5.5 Mitigation

5.5.1.1 Schedule 4 (Part 1 paragraph 21) of the 2017 EIA Regulations requires that where significant effects are identified the ES should include '*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.'*

5.5.1.2 The achievement of high environmental standards is integral to the Proposed Development. Measures to avoid, minimise and reduce impacts will be integrated into the design of the Proposed Development and its construction.

5.5.1.3 The general environmental management practices referred to in section 5.6 (i.e. embedded mitigation) will be assumed to be in place during the assessments. For each significant negative effect of the Proposed Development that is identified during the EIA, the specialists undertaking the assessments will identify mitigation measures (not already included as part of embedded mitigation) 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 (CoCP) or equivalent.

5.5.1.4 Residual effects, once specific 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.

5.6 Environmental Management

5.6.1.1 The CoCP introduces documents and the management plans that will be developed post-application into detailed documents, plans and procedures (in the form of a Construction Environmental Management Plan (CEMP)) as the Proposed Development progresses through later design processes. In addition to the specific mitigation measures identified for each of the environmental topics, the Proposed Development's CEMP (or similar) will conform to general environmental management practices and health and safety considerations.

5.6.1.2 A draft CEMP will be included as an appendix to the PEIR and ES, as a strategic level document that sets out the framework for effective management of safety, health, environmental and social impacts during the construction of the Proposed Development. The CEMP and related documents will be adopted and further developed, monitored and maintained by the Applicant's Engineering, Procurement and Construction (EPC) contractor.

5.6.1.3 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.

5.7 Engagement and Consultation

5.7.1.1 This section provides a summary of the engagement and consultation activities to be undertaken by the Applicant to inform the EIA. A detailed stakeholder mapping exercise was undertaken to identify key statutory and non-statutory stakeholders of the Proposed Development.

5.7.1.2 The Proposed Development team have undertaken a range of early engagement activities with community members, local authorities, and statutory stakeholders. A summary of engagement undertaken to date is provided below.

Table 5.1: Engagement undertaken to date

Date	Stakeholder Group	Topic
20 October 2022	Humber Local Enterprise Partnership Single Conversation Group (SCG)	Introduction of AHS Project
September 2021 onwards through regular meetings	Aldbrough Community Liaison Group (CLG)	Introduction of AHS Project and ongoing updates
13 April 2023	East Riding of Yorkshire Council (ERYC)	Scoping Report and upcoming consultation
20 April 2023	Humber Local Enterprise Partnership Single Conversation Group (SCG)	Scoping Report and upcoming consultation

5.7.1.3 The first stage of public consultation (2023) will be a hybrid format, with project information available via an online exhibition room and in-person events. The purpose of this stage of public consultation is to provide key stakeholders and members of the public with information on the Proposed Development, and the key findings of this report. Stakeholders and the wider public will be able to provide their feedback via a form, which will be provided via the online exhibition, and in hard copy at in-person events, and on request.

5.7.1.4 Consultation will be held online via a virtual consultation room for a duration of 4 weeks. In-person events will be held over one week in this consultation period at various locations, chosen to increase localised outreach. This is a chance for local stakeholders to attend these open drop-in sessions to meet the project team, ask any questions about the Project, and complete a feedback form.

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

5.8 Scope of the Assessment

5.8.1 General Considerations

5.8.1.1 The scope of the assessment falls under three broad categories:

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

5.8.2 The Technical Scope

5.8.2.1 **Chapters 6 to 8** 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.

5.8.3 The Spatial Scope

5.8.3.1 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 Proposed Development 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 Proposed Development.

5.8.3.2 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.

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

5.8.4 The Temporal Scope

Overview

5.8.4.2 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.

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

Construction Phase

5.8.4.4 Construction phase impacts may potentially arise during the whole of the construction works, as outlined in Section 2.4.3.5.

5.8.4.5 The construction phase will not be one continuous activity of the same intensity. There will be periods of above background noise 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.

5.8.4.6 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

5.8.4.7 For the operational phase, the temporal scope will be determined by the predicted date of the commencement of production, as outlined in Section 2.4.3.5, and thereafter the anticipated operating lifetime of the Proposed Development as outlined in Section 2.8.

Decommissioning Phase

5.8.4.8 The Proposed Development will have an anticipated lifespan of 30 years and is not expected to result in any abnormal environmental conditions as a result of, or following, decommissioning. Decommissioning activities are likely to commence soon after operations cease and are unlikely to take longer to complete than the construction phase.

5.8.4.9 The design life of the subsurface infrastructure (i.e. cavities and wells) will be in excess of the design life of the surface facilities. This will ensure sufficient life to allow end of life management of the wells and cavities i.e., suspension and abandonment. The design life of the above ground infrastructure (i.e CPA and wellhead) is expected to be 30 years. The design life of the seawater facilities is expected to be 10 years to permit leaching activities however such facilities will not be required to support decommissioning. The decommissioning sequence is expected to require 6 months for rewatering of the cavities, 5 years for monitoring and 40 days for well plugging.

5.9 Applying the 'Rochdale Envelope' Approach

5.9.1.1 The EIA will be undertaken in parallel to a Pre-FEED 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 EPC contractor. The FEED and detailed design processes will in part be iterative with seeking an Environmental Permit to operate the Proposed Development. Elements of the design may therefore also be influenced by post-application discussions with the EA and Health and Safety Executive (HSE). 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.

5.9.1.2 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 Planning Inspectorate, statutory consultees, and the public to develop an informed response.

5.9.1.3 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 Proposed Development 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. 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 development consent may have been granted; but

- provide sufficient detail to make an assessment of the effects and allow informed decisions on the application.

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

5.9.1.5 Such an approach is good practice, as reflected in case law on the 'Rochdale Envelope' principle (the Planning Inspectorate Advice Note Seven (June, 2020; version 7)). Suitably applied in EIA 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.

5.10 Consideration of the Main Alternatives

5.10.1.1 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.

5.10.1.2 The EIA will address alternatives including location and technology. It will also include consideration of the Proposed Development's design or 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.

5.11 Indirect, Secondary and Cumulative Impacts and Interrelationships between Impacts

5.11.1 Indirect Effects

5.11.1.1 For the purposes of this Scoping Report, indirect (or induced effects) are taken to be effects that arise from the impact of activities not explicitly forming part of the Proposed Development and therefore not under the control of the Applicant. In order to operate, the Proposed Development will require a connection to the proposed hydrogen pipeline and potentially the Electricity Transmission system. The EIA will include an appropriate consideration of activities associated with this connection together with any associated cumulative effects.

5.11.2 Secondary Impacts and Effects

5.11.2.1 Secondary impacts and effects will be assessed integrally within the assessment. For example, emissions to air will have an impact on air quality with potential effects on people and ecological populations that are directly exposed. Emissions could also lead to the deposition of acid and nutrient nitrogen to vegetation and soils with potential secondary effects.

5.11.3 Cumulative Effects

5.11.3.1 Both the EIA Directive and the 2017 EIA Regulations require an EIA to consider the potential for the Proposed Development to have cumulative effects on receptors. NPS EN-1 also refers to the consideration of cumulative effects in paragraph 4.2.5, stating that: "*The ES should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence).*"

5.11.3.2 Planning Inspectorate Advice Note 17 (Cumulative effects assessment relevant to nationally significant infrastructure projects) goes on to emphasise the importance of considering cumulative effects in the context of the EIA Directive, the Infrastructure EIA Regulations 2017 and the Overarching Energy NPS EN-1.

5.11.3.3 The Cumulative Effects Assessment ('CEA') proposed for the Proposed Development will be undertaken in line with the four-stage approach set out in Advice Note 17 as follows:

- Stage 1: Establish the Proposed Development's zone of influence (ZOI) and identify a list of other developments within it;
- Stage 2: Identify a shortlist of other developments for CEA based on their potential to have similar effects to those of the Proposed Development on the same receptors;
- Stage 3: Information gathering; and
- Stage 4: CEA.

5.11.3.4 **Chapter 9** of this Scoping Report provides detail on the approach to the CEA.

5.11.4 Impact Inter-relationships

5.11.4.1 Impact inter-relationships in the assessment will be considered in two ways as follows.

- The likely significant effects of multiple impacts from the Proposed Development on one receptor will be addressed where appropriate. For example, noise and air quality together could have a greater effect on human health and wellbeing than each impact considered separately.
- Inter-relationships between topic assessments will be addressed in terms of, for example, traffic and its noise and air quality effects on human health.

5.12 Greenhouse Gas Emissions and Climate Change Resilience

5.12.1.1 Schedule 4, part 5 of the 2017 EIA Regulations requires consideration of greenhouse gas emissions and the vulnerability of a project to climate change. It states *"A description of the likely significant effects of the development on the environment resulting from, inter alia— (f) 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*;"

5.12.1.2 The EIA will seek to quantify the greenhouse gas emissions associated with the Proposed Development and place them in context with the other related projects of the East Coast Cluster with its aims of contributing to decarbonisation of regional industry in the Humber region. The approach to be adopted for the EIA will be based on the method set out in the IEMA Greenhouse Gas (GHG) assessment guidance document (Environmental Impact Assessment Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance by the Institute of Environmental Management Assessment, 2017). This guidance sets out the following process steps:

- define scope and study boundaries;
- data collection;
- calculate GHG emissions; and
- sensitivity analysis to assess uncertainties.

5.12.1.3 Schedule 4, part 5 also requires an assessment of the Proposed Development to the effects of climate change. Two potential effects of climate change will be addressed in the EIA.

- Flood risk and its potential worsening over the Proposed Development's lifetime under future climate change scenarios will be addressed in the Flood Risk Assessment (FRA) and factored into the design of facilities, surface water run-off management and drainage (see **Section 6.4).**
- Coastal erosion and its potential worsening over the Proposed Development's lifetime under future coastal change scenarios will be addressed in a coastal geomorphology assessment and factored into the design, positioning of facilities with respect to the future projected coastline, and burial depth of marine pipelines (see **Section 7.3**)

5.12.1.4 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 DESNZ, 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.

5.12.1.5 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.

5.12.1.6 No other potential effects of climate change are considered relevant in terms of the resilience/vulnerability of the Proposed Development; only flood risk and coastal change will be considered in the EIA.

5.13 Dealing with Uncertainty

5.13.1.1 Even with a final Proposed Development 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.

5.13.1.2 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.

5.13.1.3 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.

6. ENVIRONMENTAL TOPICS AND POTENTIAL EFFECTS: TERRESTRIAL

6.1 Introduction

6.1.1.1 This section of the Scoping Report considers the potential effects from construction, operation and maintenance and decommissioning activities of the Hydrogen Storage Facility. The following topics are to be considered in this section of the Scoping Report: Geology and Ground Conditions, Water Resources and Flood Risk, Air Quality, Noise and Vibration, Ecology and Nature Conservation, Landscape and Visual Assessment, Historic Environment, and Traffic and Transport.

6.2 Study Areas

6.2.1.1 The terrestrial topic assessment study areas are clarified in Table 6.1.

Table 6.1: Terrestrial Study Areas

Topic	Study Area
Geology and Ground Conditions	500 m from the Hydrogen Storage Facility
Water Resources and Flood Risk	The hydrology study area is defined as the boundary of the Hydrogen Storage Facility (referred to as 'the Core Study Area'). The Water Resources Study area is 1 km from this Core Study Area. At distances greater than 1 km it is considered that the Proposed Development is unlikely to contribute to a hydrological effect, in terms of chemical or sedimentation effects, due to dilution and attenuation of potentially polluting chemicals.
Air Quality	The temporary and permanent Proposed Development footprints presented in **Section 2.4.1,** plus an additional 500 m buffer.
Noise and Vibration	2 km from the Scoping Boundary.
Ecology and Nature Conservation	5 km from the Scoping Boundary.
Landscape and Visual Assessment	The Study Area covers a 5 km radius from the Hydrogen Storage Facility. Beyond 5 km, the Proposed Development is unlikely to be perceptible within the landscape, as mentioned in the ES for AGS. Following the Hydrogen Storage Facility assessment, a smaller, Detailed Study Area ('DSA') within 2 km may be adopted, to focus on the areas where the greatest landscape and visual impacts may occur. A 1-2 km radius will be used for the assessment of residential properties, given the lightly settled nature of the location.
Historic Environment	Within the Scoping Boundary (designated and non-designated sites) and 2 km from the Scoping Boundary (designated sites). Previous investigations in the immediate vicinity of the Proposed Development were also assessed.
Traffic and Transport	The Study Area has been defined by the public road network in the vicinity of the Proposed Development and potential delivery corridors to be used during construction. These take into account the local and strategic road network, sources of labour and the potential sources of construction materials, specifically stone and concrete from local quarries. The following roads are anticipated to be included in the study area: A165, A1033, B1238 and the B1242. The likely route to the Proposed Development for Abnormal Indivisible Loads is from the Port of Hull (Queen Elizabeth Dock) then via the A1033, A165, B1238, and the B1242.

6.3 Geology and Ground Conditions

6.3.1 Introduction

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

6.3.1.2 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.

6.3.2 Topic-specific Regulatory Requirements and Guidance

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

- NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4).
- WFD (2000/60/EC). The WFD establishes a framework for the protection, improvement and sustainable use of all water environments.
- The Environmental Protection Act 1990. This makes provisions for the improved control of pollution arising from certain industrial and other processes, relating to waste and the collection and disposal of waste. In particular, Part IIA (as created by the Environment Act 1995) focuses on dealing with contaminated land in England.
- European Union Groundwater Directive (2006/118/EC) 2006. The aim of the Directive is to protect groundwater against pollution caused by dangerous substances.
- Water Resources Act 1991 as amended by the Water Act 2003. The Act (as amended) provides the definition of and regulatory controls for the protection of water resources, including the quality standards expected for controlled waters.
- EA/ Department for Environment, Food and Rural Affairs (DEFRA) Land Contamination Risk Management (LCRM) 2020. This document provides guidance on how to assess and manage the risks from land contamination.

6.3.3 Baseline Environment

Data Sources used in Scoping

6.3.3.2 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 Geology of Britain interactive viewer (accessed August 2022);
- AHS Feasibility Study Report, Atkins (April 2022) ref. PM813-AT-A-IC-00001;
- AHS Basis for Design, Atkins (August 2022) ref. PM813-AT-Z-RA-00001;
- DEFRA Magic map (accessed August 2022);
- Coal Authority Interactive Viewer (accessed August 2022);

- 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 August 2022).

6.3.3.3 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 PEIR. A targeted walkover of areas of interest will be undertaken as part of the assessment if the desk-based review indicates this is necessary.

Description

Land Use and Ground Conditions

6.3.3.4 The Hydrogen Storage Facility 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 with very little industrial land use or potential contaminative activities. The exception being AGS (an upper-tier Control of Major Accident Hazards (COMAH) site), which is located adjacent to the north and first developed with a borehole in c.1993.

6.3.3.5 The Proposed Development is located adjacent to the existing SSE Thermal operated AGS, which includes nine caverns for the underground storage of natural gas with a capacity of around 300 mcm. The following potential sources of contamination were identified within the Atkins AHS Basis of Design report.

- Three “unspecified tanks” are shown on Aldbrough Sands beach (on site) 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.

6.3.3.6 According to the ERYC landfill dataset and illustrated on Figure 6.1, there are no historic or current recorded landfill sites within 1 km of the proposed Hydrogen Storage Facility.

6.3.3.7 Natural England classifies the majority of agricultural land in the study area as Grade 3 (‘good to moderate’) and Grade 2 (‘very good’) in the southern part of the Hydrogen Storage Facility study area.

Geology

6.3.3.8 The regional and local geology is well defined within the Atkins Feasibility Study Report with data obtained during the AGS 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 and are suitable for underground gas storage.

6.3.3.9 The Hydrogen Storage Facility is underlain by topsoil followed by Quaternary glacial deposits (Glacial Till and Alluvium) from ground level to ~42 m bgl. Alluvium (clay, silt, sand and gravel) is present towards the north of the Proposed Development, associated with East Newton Drain. Below the superficial deposits 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 ~1594 m bgl, salt bearing

Permian Zechstein (unconfirmed thickness) and Carboniferous (Coal Measures (unconfirmed thickness)) bedrock strata.

6.3.3.10 The steep cliffs at Aldbrough face north-east and have a regular height of approximately 20 m. The cliffs are actively receding, and the cliff profile is stepped due to the contrasting erosion resistances of the tills and the different erosional processes in the upper and lower parts of the cliff. It is understood the annual average coastal erosion rate in this area can be up to 4 m. However, the erosion tends to occur irregularly, with none or very little for several years followed by relatively rapid losses of larger amounts. Coastal erosion is assessed within **Section 7.3**.

Mineral Resources

6.3.3.11 There are no nationally designated geological SSSI sites within 1 km of the proposed Hydrogen Storage Facility. In addition, the East Riding of Yorkshire and Kingston upon Hull Joint Minerals Local Plan (adopted November 2019) does not identify any mineral safeguarding areas within the vicinity of the Hydrogen Storage Facility. There are no artificial deposits identified within the study area.

6.3.3.12 The site is underlain by deep coal deposits which are anticipated to be greater than 2000 m bgl. The Coal Authority online mapping (accessed August 2022) shows the onshore Proposed Development is not located within an area of past or current coal mine workings. The offshore Proposed Development boundary is shown to be located within a coal mining reported area that extends from the mean low water mark east approximately 4 km offshore. However, it is outside of the areas indicated to be a Development High Risk Area for coal mining.

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

Hydrogeology

6.3.3.14 The EA classifies the Glacial Till as a secondary undifferentiated aquifer, which is a designation assigned in places for which it is not possible to apply either a secondary A or B definition due to the variable characteristics of the rock type. The Alluvium is classified as a secondary A aquifer, which includes permeable layers that can support local water supplies and may form an important source of base flow to rivers.

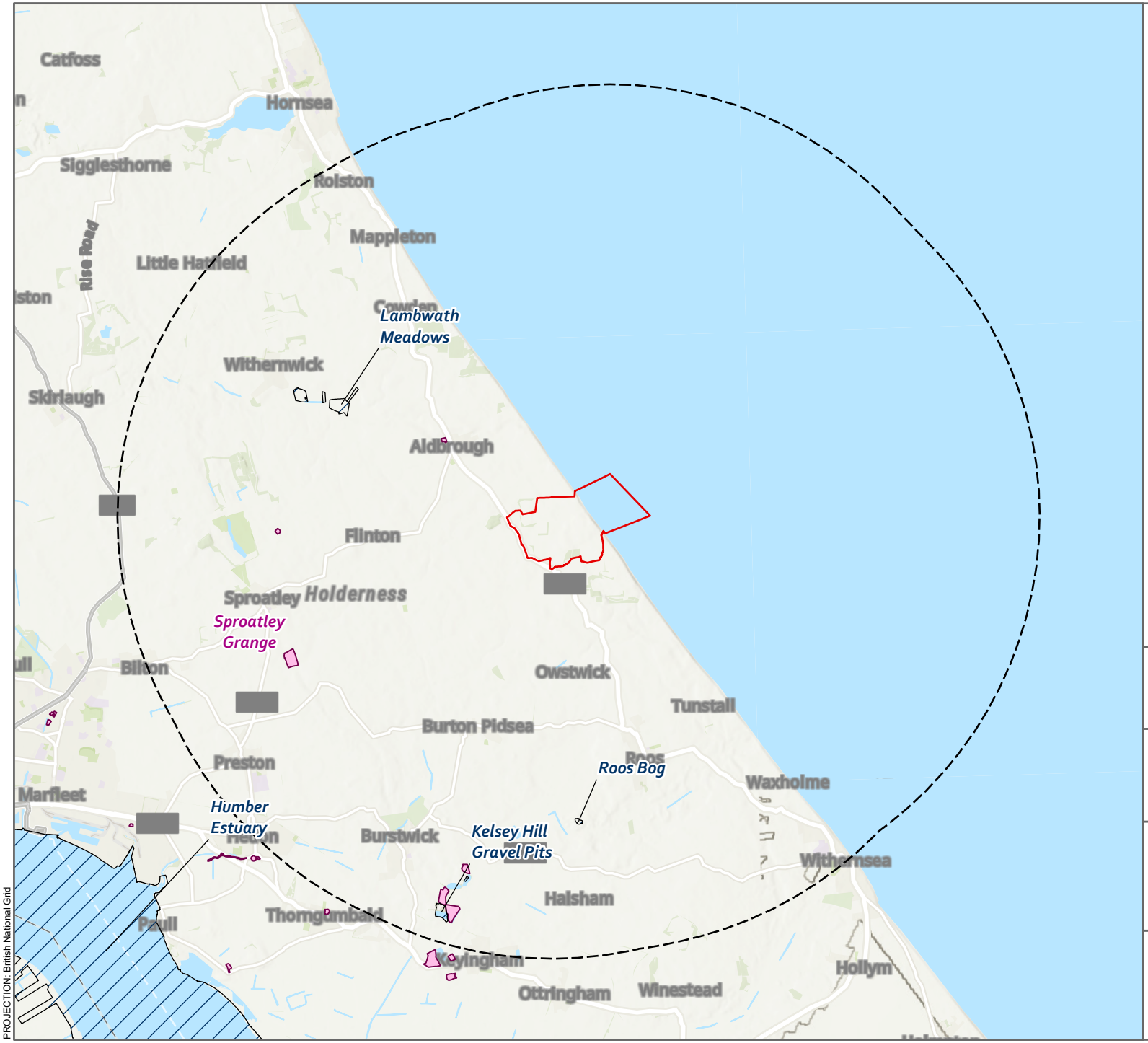
6.3.3.15 The Rowe Chalk Formation is classified as a principal aquifer, which has high intergranular and/or fracture permeability meaning it can usually provide a high-level of water storage and may support water supply and/or river base flow on a strategic scale.

6.3.3.16 The EA has classified the underlying regional groundwater unit as having ‘Poor’ quantitative and chemical quality under the 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.

6.3.3.17 SSE Hornsea Limited holds a licence to abstract groundwater from the underlying Rowe Chalk aquifer for the rewatering (filling) of underground caverns (Ref. NE/026/0033/011). This licence has a maximum abstraction rate of 500,000m^3/year (not exceeding 40 l/s).

6.3.3.18 There are no groundwater source protection zones (SPZ) designated to protect public groundwater supply abstractions within the study area, according to the MAGiC website (accessed August 2022).

6.3.3.19 It is understood that no potable groundwater abstractions are recorded within 500 m of the Hydrogen Storage Facility. This will be confirmed on receipt of further baseline data in the form of an environmental database and consultation with ERYC and the EA.



Scoping Boundary

Scoping Boundary - 10km Buffer

Site of Special Scientific Interest

Historic Landfill Sites

0 1 2 3 4 5

Kilometres

N

SCALE: See Scale Bar	VERSION: A05
SIZE: A4	DRAWN: GB/HD
PROJECT: 0630444	CHECKED: ES
DATE: 10/05/2023	APPROVED: ES

Figure 6.1
Potential Areas of Contamination and Sensitive Areas

ERM

equinor

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - Ground Condition 10km - A05

Key Sensitivities

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

- Human Health (onsite construction / operation workers and offsite residential / commercial);
- the nearest residential receptor is located approximately 20 m to the west and south-west of the Hydrogen Storage Facility boundary;
- the eastern offshore area of the Proposed Development is located within the Greater Wash Special Protected Area and the Holderness Inshore Marine Conservation Zone;
- Bail Wood Ancient Woodland is located approximately 130 m west of the Hydrogen Storage Facility;
- several drainage ditches and watercourses within the study area and adjacent to the Proposed Development;
- Managing coastal change;
- alluvium secondary A aquifer and both the Rowe and Flamborough Chalk Formation principal aquifers; and
- existing agricultural land.

6.3.3.21 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.

6.3.4 Project Basis for Scoping Assessment

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

- Sea water leaching will be used for the construction of up to nine salt caverns to depths between 1750 m and 1950 m bgl.
- Soils and geology will only be exposed to impacts within the temporary construction and permanent surface infrastructure footprints (central processing area, well head platforms and onshore cofferdam) noting that the locations and extents of activities will be refined as the design progress.
- The Marine Infrastructure (seawater intake and brine outfall pipes) will be installed between the pipeline trench and the clifftop using HDD and connecting to a deep wet well constructed onshore. It is understood that a temporary cofferdam will be constructed for the tie in of the HDD pipeline with the marine pipe trench.
- The Proposed Development does not involve the extensive processing, handling and storage of hazardous materials (except underground hydrogen storage) or require intrusive maintenance activity, therefore there is limited potential for effects on geology and soils during operation.
- During operation it is anticipated that maintenance and repair activity outside of the central processing area, well head platforms and onshore elements of the marine infrastructure 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 caverns and reinstatement of the storage facility to a suitable condition for future development. It is understood the pipeline will be retained and capped during decommissioning.

6.3.4.2 Inputs from other topics regarding inter-related effects on human health, water environment, ecological receptors and the marine environment are also considered.

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

6.3.5 Mitigation

6.3.5.1 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.

6.3.5.2 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.

6.3.5.3 Mitigation measures will evolve over the development process as the EIA progresses and in response to S42 and S47 consultation.

6.3.6 Likely Significant Effects to be Considered in the EIA

6.3.6.1 Table 6.1 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 6.2: Likely Effects – Geology and Ground Conditions

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Sterilisation of future mineral resources: Construction and Operational phase of the Hydrogen Storage Facility	N/A	No change or Negligible	Medium / High	No likely significant effects. The Hydrogen Storage Facility is not located within or near to minerals safeguarding areas.	Scoped Out. Effects avoided; no further assessment required.	N/A
Damage to designated geological SSSI: Construction phase	Geological SSSI sites will be avoided by the permanent project footprint.	No change or Negligible	High	No likely significant effects. The Hydrogen Storage Facility is not located within or near to a designated geological SSSI.	Scoped Out. Effects avoided, no geological SSSIs within 1km. No further assessment required.	N/A
Exposure of workforce to health impacts: Construction phase	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.	Small	Medium	No likely significant effects. Any pathways between receptor and source will be avoided through use of PPE.	Scoped Out. Protective measures will be outlined in a CEMP.	N/A
Encountering contamination during intrusive works: Construction	Any contamination encountered during the construction phase will be subject to appropriate risk	Medium	Likely to range from low to high	Likely significant effects without mitigation. Whilst the majority of the site is agricultural land there	Scoped In. Further assessment involving site walkover and baseline review of	Baseline data review to include identification of geology, hydrogeology and potential sources of

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
phase construction activities (all project components)	assessment and if necessary, either removed, treated and/ or mitigated as part of the Proposed Development.			is the potential for localised contamination to exist due to the historic and current land use. Construction activities could disturb contaminants, which could result in impacts on soil / land use, and pollution of groundwater.	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.	contamination. Data sources to include BGS data, Envirocheck data, 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 Soils on Construction Sites PB13298.	Small	Low	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 measures, will be described in a soils management plan or similar as part of the CEMP.	Baseline data review to include identification of different soil classes and their characteristics and vulnerability to compaction.
Dewatering of trenches and excavations: Construction phase	Construction of pipelines (Marine Infrastructure) will be completed by HDD. Temporary treatment of water will be considered in the CEMP to reduce the sediment load and any contamination prior to	Small	Medium	Likely significant effects without mitigation. Construction of the wet well will likely require dewatering of perched water or groundwater which could reduce groundwater flow and affect water quality and base flow of local	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.

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
	discharge into an approved water course.			watercourses and abstractions.		
Physical intrusion into groundwater resource: Construction phase (installation of foundations, cofferdams and well head drilling)	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.	Medium	High	Likely significant effects without mitigation. Drilling fluids and formation waters in the borehole and cavern construction phase 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 phase	Standard construction and drilling industry practices will be adopted to mitigate potential impacts on soil quality from accidental spills or leaks.	Negligible	Likely to range from low to high	No likely significant effects. Whilst there is 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 CEMP will outline preventative measures and contingency plans.	N/A
Decommissioning phase - The impacts during decommissioning will be similar, and potentially less than outlined for the construction phase, based on the rewatering of the salt caverns using uncontaminated brine.						

6.3.7 Effects Scoped out of the EIA

6.3.7.1 The following sections detail the impacts that have been scoped out of the assessment, 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).

Sterilisation of future mineral resources and damage to designated geological SSSI during construction and operation

6.3.7.2 Nationally designated geological SSSI sites have not 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.

Exposure to workforce health impacts during construction

6.3.7.3 There is the potential that during construction-related activities, specifically groundworks including 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 will be conducted, and appropriate measures taken to protect human health and the environment.

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

6.3.7.4 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 2009 Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298. Post-construction these working areas will be reinstated to pre-existing condition as far as reasonably practicable. Taking into consideration that the majority of the site is subject to agricultural activity including ploughing and other heavy machinery movements, the potential for compaction effects with mitigation in place is minimal.

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

6.3.7.5 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.

6.3.8 Proposed Approach to the Assessment

Baseline

6.3.8.1 The assessment will consider potential effects on geology, land and groundwater resources and related designated sites. A Phase 1 desk-based assessment (DBA) 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 and designated sites) to develop a conceptual site model (CSM).

6.3.8.2 Additional baseline information will be collated 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.

6.3.8.3 The Envirocheck report will include up to date datasets (onsite 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.

6.3.8.4 An Agricultural Land Classification Survey will be completed for inclusion in the PEIR to further classify the quality of land for agricultural use within the Proposed Development. 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.

6.3.8.5 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.

6.3.8.6 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.

Specific Methodologies

6.3.8.7 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.

6.3.8.8 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).

6.3.8.9 Land contamination may be a hazard but does not constitute a risk unless all three elements are present and therefore create a pollutant linkage. 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.

Assessment Criteria

6.3.8.10 The sensitivity of potential receptors can be described qualitatively according to the categories presented in Table 6.3.

Table 6.3: 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 (LNR) ▪ 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.

6.3.8.11 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 6.4.

Table 6.4: 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

6.3.8.12 The significance of effect is determined by assessing the potential magnitude of impact on the receptors against the sensitivity of the receptor. Table 6.5 presents the matrix showing the significance of effects. Moderate or major effects are considered significant in EIA terms.

Table 6.5: 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

6.4 Water Resources and Flood Risk

6.4.1 Introduction

6.4.1.1 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.

6.4.2 Topic-specific Regulatory Requirements and Guidance

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

- NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4).
- WFD (2000/60/EC)[8] as implemented in England via the WFD (England and Wales) Regulations 2003[9]. The WFD establishes a framework for the protection, improvement and sustainable use of all water environments;
- EU Directive 2008/105/EC (the Priority Substances Directive)[10];
- EU Directive 2007/60/EC on the Assessment and Management of Flood Risks (the Floods Directive)[11];
- The Water Act 2014[12];
- Water Resources Act 1991 (as amended) Section 85[13];
- Environmental Protection Act 1990[14];
- Flood and Water Management Act 2010[15];
- The Bathing Water Directive (2006/7/EC)[16] as implemented by the Bathing Water Regulations 2013;
- Flood and Water Management Act 2010[17];
- Land Drainage Act 1991[18];
- British Standard Code of Practice for Earthworks BS 6031 2009[19];
- The Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C741) (2015). C741 provides guidance on how to avoid causing environmental damage when on a construction site;
- CIRIA Control of Water Pollution from Construction Sites (C532) (2001). C532 provides guidance on how to plan and manage construction projects in order to control water pollution; and

[8] 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"). [online] Available at: http://ec.europa.eu/environment/water/water-framework/index_en.html (Accessed 12/05/2022).
[9] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. Available Online. https://www.legislation.gov.uk/uksi/2003/3242/contents/made (Accessed 12/05/2022).
[10] 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. https://eur-lex.europa.eu/eli/dir/2008/105/oj (Accessed 30/06/2022).
[11] 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. https://ec.europa.eu/environment/water/flood_risk/ (Accessed 30/06/2022).
[12] https://www.legislation.gov.uk/ukpga/2014/21/contents/enacted
[13] https://www.legislation.gov.uk/ukpga/1991/57/contents
[14] https://www.legislation.gov.uk/ukpga/1990/43/contents
[15] https://www.legislation.gov.uk/ukpga/2010/29/contents
[16] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0007
[17] https://www.legislation.gov.uk/ukpga/2010/29/contents
[18] https://www.legislation.gov.uk/ukpga/1991/59/contents
[19] The British Standards Institute (BSI) (2009). "BS 6031:2009 Code of Practice for Earthworks" [online] Available at: https://knowledge.bsigroup.com/products/code-of-practice-for-earthworks/standard [Accessed 26/07/2022].

- EA Pollution Prevention Guidelines (PPGs)[20] and General Pollution Plans (GPPs), whilst archived, give advice on statutory responsibilities and good environmental practice.

6.4.3 Baseline Environment

Data Sources used in Scoping

6.4.3.1 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[21];
- EA Catchment Data Explorer[22];
- Internal Drainage Boards (IDB) Map[23];
- DEFRA Magic Map[24]; and
- Atkins Aldbrough Hydrogen Storage Project Feasibility Study Report [25].

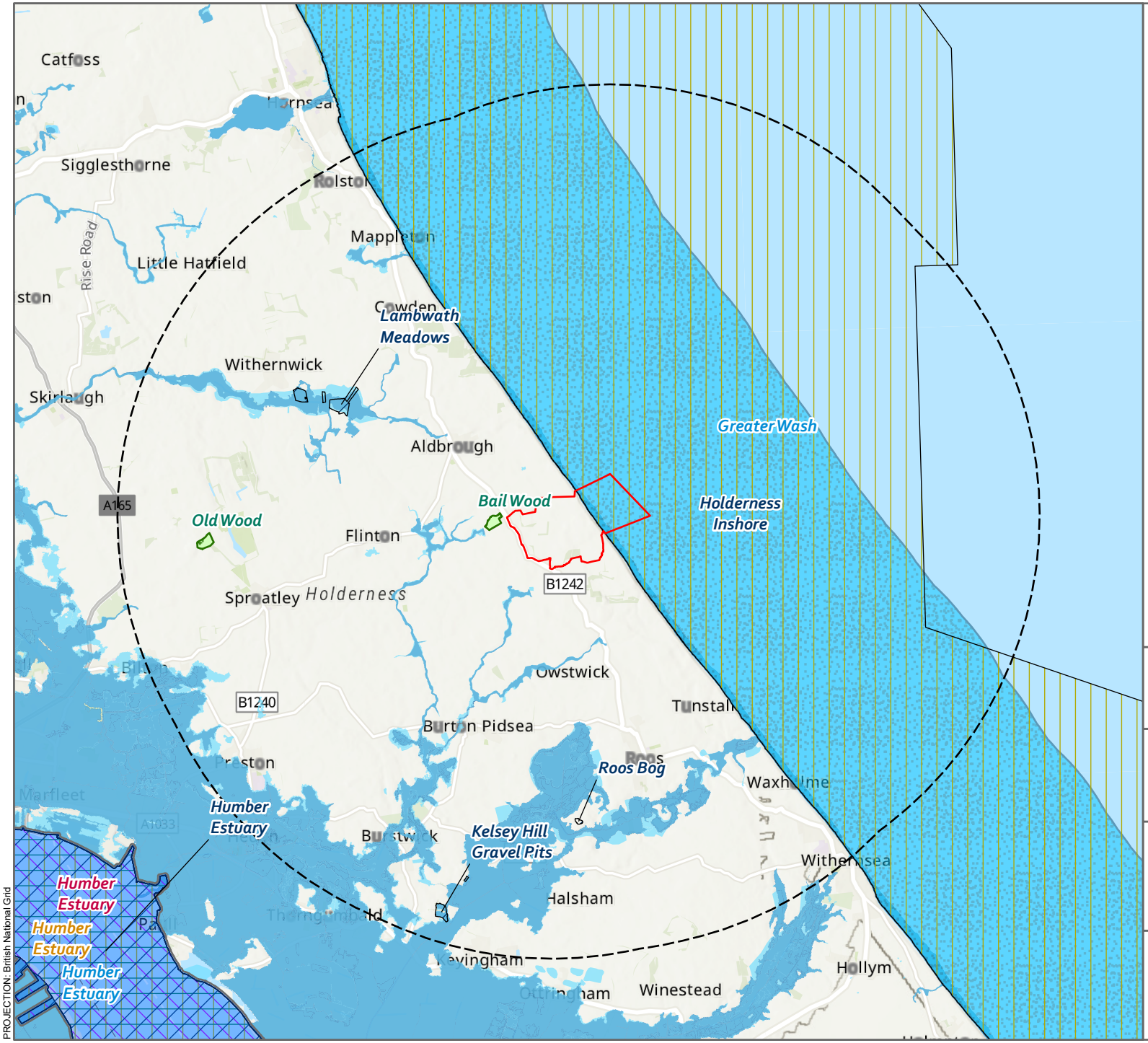
Description

6.4.3.2 As part of the DBA 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;
- flood risk including in relation to construction and operation in areas of fluvial flood risk;
- water resources including public and private water supplies, and licenced abstractions and discharges; and
- designated sites.

6.4.3.3 The study areas are shown on Figure 6.2.

[20] NetRegs (2022), Guidance for Pollution Prevention (GPP) documents [online] Available at: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/ [Accessed 19/07/2022].
[21] Environment Agency (2021) Flood Map for Planning [Online] Available at: https://flood-map-for-planning.service.gov.uk/ (Accessed 24/06/2022)
[22] Environment Agency (2022) Catchment Data Explorer [Online] Available at: https://environment.data.gov.uk/catchment-planning/ (Accessed 24/06/2022)
[23] Association of Drainage Authorities (2022) Internal Drainage Boards Map [Online] Available at: https://www.ada.org.uk/idb-map/ (Accessed 12/05/2022).
[24] DEFRA (2022) Magic Map Application [Online] Available at: https://magic.defra.gov.uk/magicmap.aspx (Accessed 12/05/2022).
[25] Atkins (2022) Aldbrough Hydrogen Storage Project Feasibility Study Report



- Scoping Boundary
- Scoping Boundary - 10km Buffer
- Watercourse 50m Buffer
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- Ramsar Sites
- Marine Conservation Zone
- Ancient Woodland
- Fluvial Flood Risk Zone 2
- Fluvial Flood Risk Zone 3

0 1 2 3 4 5
Kilometres

N

SCALE: See Scale Bar	VERSION: A06
SIZE: A4	DRAWN: GB/HD
PROJECT: 0630444	CHECKED: ES
DATE: 10/05/2023	APPROVED: ES

Figure 6.2
Water Resources and Flood Risk Study Areas

ERM

equinor

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - Water Risk 10km - A06

Surface Water

6.4.3.4 There are several artificial drainage ditches (associated with agricultural land) and two artificial ponds located onsite. This is in addition to a section of the East Newton Drain which flows from east to west across the Hydrogen Storage Facility and Bail Drain which joins from the west. Soldiers' Dike runs along the eastern boundary of the Hydrogen Storage Facility and Cess Dale Drain flows north-east from the north-west corner of the Core Study Area.

6.4.3.5 Soldiers' Dike and Cess Dale Drain and a section of East Newton Drain flow to discharge to the North Sea in the east.

6.4.3.6 A small area within the northern section of the Core Study Area lies within the area of the South Holderness IDB.

6.4.3.7 The Core Study Area lies within the Humbleton Beck catchment, 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). 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.

Flood Risk

6.4.3.8 Most of the land within the Core Study Area is located within Flood Zone 1, with areas along the coast in the north-east within Flood Zones 2 and 3. The EA Flood Map for Planning indicates that the Core Study Area is generally at low risk of surface water flooding, with some isolated areas at high risk, often associated with drains within the Core Study Area.

6.4.3.9 The land contained within the Core Study Area is not at risk of flooding from reservoirs.

Water Resources

6.4.3.10 As identified in recent studies, there is one known groundwater abstraction from the underlying bedrock aquifer, which is associated with AGS. 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 Core Study Area.

6.4.3.11 The DEFRA Magic Map[24] viewer shows that the Core Study Area does not lie within a Drinking Water Safeguard Zone for surface water.

6.4.3.12 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, Yorkshire Water and the Council to inform the assessment of potential effects.

Designated Sites

6.4.3.13 There are no designated sites within the onshore element of the Core Study Area.

6.4.3.14 The area of the North Sea (within the east of Core Study Area) forms part of the Greater Wash area, which has been designated as an SPA and the Holderness Inshore a MCZ, related to the presence of sand banks that support marine habitats. This area is hydrologically connected to the land within the Core Study Area.

Key Sensitivities

6.4.3.15 The sensitivities of the identified receptors are detailed in Table 6.6.

Table 6.6: Sensitivity of Receptors

Receptor	Sensitivity[26]	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 the Holderness Inshore 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 EA and Yorkshire Water to confirm the presence of abstractions.

6.4.4 Project Basis for Scoping Assessment

6.4.4.1 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 due to construction works, including excavations and piling activities;
- chemical pollution because of fires, leaks or spillages;
- pollution from construction vehicles or plant on site;
- pollution due to chemicals from contaminated land being released, since there is potential for runoff/movement of contaminated groundwater into surface waters via storm drains;
- impediments to watercourse from shallow and deep foundations (including piling), dewatering and excavation works;
- 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.

6.4.4.2 Long-term effects from the operational phase could include:

- increased run-off and flood risk from increased hardstanding including permanent access roads;
- pollution risks from operational processes onsite, associated with the movement, and storage of hydrogen; and
- pollution from operational traffic (on-site maintenance activities) due to accidental spillages.

6.4.4.3 Impacts from the above activities are unlikely to lead to significant effects with the application of good practices and mitigation measures to be included in design.

[26] Sensitivity class is determined using Table 2: Framework for Determining Importance and Sensitivity of Receptors

6.4.5 Mitigation

6.4.5.1 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 chapters of the PEIR and ES.

6.4.6 Likely Significant Effects to be Considered in the EIA

6.4.6.1 Table 6.7 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 actions, including baseline data acquisition, for significant effects have been scoped in. The basis for scoping out certain effects is presented after the table.

6.4.6.2 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 or overall 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.

6.4.6.3 As decommissioning will be more than 30 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.

6.4.6.4 It is unlikely that there will be significant effects from the Proposed Development on the hydrological environment with the implementation of mitigation outlined above; however, further assessment will confirm this.

Table 6.7: Likely Effects – Water Resources and Flood Risk

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Chemical pollution: Construction and Operation	Standard good practice measures	Negligible	Likely to range from Low to High	Minor – Not significant	Scoped In. Likely to not be significant but consultation with EA on embedded mitigation still required so scoped in for further assessment.	Review of embedded mitigation within design Consultation with EA
Erosion and sedimentation: Construction and Operation		Negligible	Medium	Minor – Not significant	Scoped In. Likely to not be significant but consultation with EA on embedded mitigation still required so scoped in for further assessment.	
Impediments to flow: Construction and Operation		Negligible	Medium	Minor – Not significant	Scoped In. Likely to not be significant but consultation with EA on embedded mitigation still required so scoped in for further assessment.	
Well head drilling: Impacts on groundwater Construction		Medium	High	Likely significant effects without mitigation. Drilling fluids and formation waters in the borehole and cavern construction phase may impact groundwater.	Scoped In. Further assessment involving baseline review of pathway and receptors.	

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Increased runoff and flood risk: Construction and Operation	Standard good practice measures. Design of drainage system	Small	Medium	Minor – Not significant	Scoped In. .	EA and IDB consultation
Impacts on public and private water supplies (including licensed abstractions and discharges): Construction and Operation	Good practice measures outlined within the CEMP Surface Water Quality Monitoring (if required)	Negligible	Medium to High	Minor – Not significant	Scoped In.	Consultation with Yorkshire Water, the EA 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: Construction	Good practice measures outlined within the CEMP	Negligible	High	Minor – Not significant	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.

6.4.7 Effects Scoped out of the EIA

6.4.7.1 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).

6.4.7.2 Likely significant effects are not anticipated, however further desk study and consultation are required, and mitigation measures are to be developed in detail to confirm this.

6.4.7.3 Impacts on water quality from chemical pollution, erosion and sedimentation on designated sites (SACs and MCZs) have been scoped out and subsequently screened out of any HRA. 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.

6.4.8 Proposed Approach to the Assessment

Baseline

6.4.8.2 The approach for the Water Resources and Flood Risk section for the Core Study Area has been developed in consultation with the EA and other statutory consultees over a number of years. The assessment 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.

6.4.8.3 A walkover will be carried out to ground-truth hydrological conditions at the Hydrogen Storage Facility although it does not cross any watercourses.

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

6.4.8.5 For the Hydrogen Storage Facility there will be a requirement to undertake a FRA compliant with the requirements of the NPPF and NPS will be undertaken to assess any flood risk.

Specific Methodologies

6.4.8.6 In relation to Flood Risk, as sections of land within the Core Study Area are located within Flood Zone 3, the FRA will need to demonstrate that the Proposed Development passes the Exception and Sequential tests outlined in the NPPF and NPS. There will be a requirement to raise all electronically sensitive equipment at least 600 mm above the highest modelled flood level for the 1 in 100-year (+climate change) fluvial event and the 1 in 200-year tidal event or have a commitment to install flood resilient measures for onsite infrastructure. The climate change allowance data will be obtained from the EA Climate Change Allowances for Peak River Flow in England (2021) for the appropriate catchment and basin. The EA's climate change data is based upon UKCP18 with different epochs or periods of time reflecting the emissions scenarios within UKCP18.

6.4.8.7 The FRA will be produced and will focus on the following elements:

- the risk of flooding from fluvial and groundwater sources;
- assessment of the introduction of new hardstanding areas on the greenfield run-off rates; and
- calculating the sizing of storage tanks and Sustainable Drainage Systems (SuDS) required to accommodate an increase in surface water run-off.

- In relation to downstream designated sites – as there are multiple designated sites the HRA process will identify any likely significant effects in relation to water quality impacts. Full detail is outlined within **Section 6.7**.
- The requirement for any discharge to estuarine (transitional) and coastal waters is currently unconfirmed. Following a WFD screening exercise, a WFD Compliance Assessment Report may be required. This will be incorporated into the overall assessment of effects on water resources. An assessment for the WFD Report will involve consideration of the WFD status of surrounding water bodies. The WFD Report will need to be approved by the EA and would form an Appendix to the ES.

Assessment Criteria

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

6.4.8.9 Table 6.8 details the framework for determining importance of receptors and their sensitivity to adverse impacts from the Proposed Development.

Table 6.8: 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 SACs and 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 LNR's), as defined by the EA or Natural England.
Low	■ A large, medium or small water body with an 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.

Importance and Sensitivity of Receptor	Definition
	■ The hydrological receptor does not support abstractions for public water supply or private water abstractions.

Magnitude of Impact

6.4.8.10 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.

6.4.8.11 The criteria for assessing the magnitude of an impact are presented in Table 6.9.

Table 6.9: 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.

Significance of Effect

6.4.8.12 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 6.10 summarises guideline criteria for assessing the significance of effects.

Table 6.10: 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

6.4.8.13 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.

6.5 Air Quality

6.5.1 Introduction

6.5.1.1 This section identifies the potential effects on ambient air quality from construction, operation (including maintenance) and, where relevant, decommissioning activities of the Hydrogen Storage Facility. Considering that:

- the power supply strategy for the development is grid connection for both the non-permanent and operational phases;
- all rotating and packaged equipment will be electrically driven rather than powered by the use of local generators with associated combustion of fuel;
- there will be a backup generation supply to the facility, but no on-site power generation based on combustion technology (e.g. diesel generators);
- process heating in the Adsorption Regeneration system will be achieved via electric heaters;
- a hydrogen vent or flare system will be used for emergencies; and
- heating, cooling or steam to support utility systems which will all be electrically generated.

6.5.1.2 The potential for significant effects on receptors from air quality impacts lies primarily with the construction phase. The principal impacts of interest are dust and particulate matter (as PM_{10}), due to construction activities and nitrogen dioxide (NO_2) from construction traffic. If a flare is used for emergencies and maintenance during the operational phase, then this would be associated with temporary, non-planned, emissions of NO_x.

6.5.2 Topic-specific Regulatory Requirements and Guidance

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

- NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4).
- Environment Agency, 2016, Air emissions risk assessment for your environmental permit[27];

[27] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

- Air Quality Standards imposed in UK law (The Air Quality Standards Regulations 2010 Statutory Instrument 2008/301[28], transposed from EU standards (European Union Air Quality Standards[29]); and
- Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction, Version 1.1[30].

6.5.3 Baseline Environment

Data Sources used in Scoping

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

- DEFRA online interactive monitoring networks map[31];
- DEFRA's online UK Ambient Air Quality Interactive Map[32];
- DEFRA's online Air Quality Management Area Interactive Map[33]; and
- local authority monitoring data[34].

Description

6.5.3.2 The Hydrogen Storage Facility is not located within an Air Quality Management Area (AQMA). 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.

6.5.3.3 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.

Key Sensitivities

6.5.3.4 With the exception of AGS, the Hydrogen Storage Facility is located in a largely rural area. For air quality, the number of sensitive receptors is limited and air quality is not constrained

[28] http://www.legislation.gov.uk/uksi/2010/1001/contents/made
[29] http://ec.europa.eu/environment/air/quality/standards.htm
[30] https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf
[31] https://uk-air.defra.gov.uk/interactive-map
[32] https://uk-air.defra.gov.uk/data/gis-mapping
[33] https://uk-air.defra.gov.uk/aqma/maps/
[34] https://eastriding.maps.arcgis.com/apps/webappviewer/index.html?id=2cd47837a1e34b8da43424f5071ea55c

with regards to concentrations of PM_{10}, NO_2 and NO_x pollution. No AQMAs have been identified within or adjacent to the Scoping Boundary.

6.5.3.5 The key sensitivities will therefore 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; and
- If instead of a vent for hydrogen release during an emergency or maintenance, a flare system is used, short term emissions of NO_x will be assessed over a larger area (max. 15 km radius from flare). Since this would be unplanned short-term events, the potential impacts will be short-term, and as such limited to assessment against the 1-hour NO_2 standard for the protection of human health and the 24 hr NO_x standard for protection of ecological habitats.

6.5.4 Project Basis for Scoping Assessment

6.5.4.1 The air quality scoping assessment is based on the following:

- the temporary and permanent Proposed Development footprints presented in **Section 2.4.1**, plus an additional 500 m buffer;
- the likely nature, location and extent of the construction activities as outlined in **Section 2.4.1**; and
- the likely nature of operational and maintenance activities as outlined in **Section 2.7**.

6.5.4.2 The methodology used to assess impacts for the Proposed Development is based on IAQM guidance (see **Section 6.5.16.5.2**).

6.5.4.3 The sensitivity of receptors within the radius of potential impacts from dust raising (500 m 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.

6.5.4.4 For other types of impact, residential areas are considered to be of medium sensitivity. High sensitivity applies to hospitals and schools, neither of which have been identified within the air quality study area.

6.5.4.5 The basis for assessment also includes the embedded mitigation where appropriate.

6.5.5 Mitigation

6.5.5.1 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[35]. Adhering to this guidance in general makes it possible to render these impacts negligible, or at worst small.

6.5.5.2 Operational impacts are expected to be negligible since combustion activities are not foreseen (see **Section 6.5.1**), with the exception of possible short term flaring.

6.5.5.3 It is also assumed that a vent/flare system will be used for emergencies, which again is mostly of concern for short term impacts. Most appropriate mitigation for emergency venting/flaring is limited to reducing the number of events which is inherent for this type of

[35] construction-dust-2014.pdf (iaqm.co.uk)

activity. It is worth noting that vented hydrogen has no implications to air quality or human health, and that hydrogen venting is therefore scoped out for air quality impact assessment.

6.5.6 Likely Significant Effects to be Considered in the EIA

6.5.6.1 Table 6.11 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 have been scoped in. The basis for scoping out certain effects is presented after the table.

6.5.6.2 As decommissioning will be more than 30 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.

Table 6.11: Likely Effects – Air Quality

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	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.	Negligible to small with appropriate mitigation	High	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 Hydrogen Storage Facility. Based on the current Power Supply Strategy for the development, no relevant emissions to the atmosphere will be associated with the operations of the Hydrogen Storage Facility.	All rotating and packaged equipment will be electrically driven by power from the National Grid. There will be no on-site power generation using combustion technology. Process heating will be achieved via electric heaters. Heating, cooling or steam to support utility systems will be electrically generated.	Negligible	Medium	Not significant	Scoped Out (under current Power Supply Strategy)	None
Emergency flaring or flaring during maintenance (to be confirmed)	Limited number of events	Small to Large depending on duration	Medium	Minor to Major depending on duration and volumes flared. Limited to short term impacts.	Scoped In	None

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
		and volumes flared. Limited to short term impacts.				
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	Negligible	Medium	Not significant. The maximum increase of HDV 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 guidance provided by the UK Highways Agency[36]).	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	Small with appropriate mitigation	High (to be re-assessed when decommission is scheduled)	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

[36] file:///C:/Users/Yves.Verlinden/Downloads/LA%20105%20Air%20quality-web.pdf

6.5.7 Effects Scoped out of the EIA

6.5.7.1 Whilst 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).

6.5.7.2 Based on Table 6.11 above, it is assumed at this stage that the only relevant emissions to the atmosphere associated with the operation of the Hydrogen Storage Facility will be from emergency flaring and flaring during maintenance, and this is only if the flaring option is preferred over venting. Therefore operation of the Hydrogen Storage Facility is scoped out of further assessment except for emergency flaring and flaring during maintenance.

6.5.8 Proposed Approach to the Assessment

Baseline

6.5.8.1 Baseline air quality data (PM_{10} and if relevant NO_x/NO_2) will be sourced from national or local monitoring networks, and modelling undertaken by local authorities where available and from national modelling outputs (background mapping). No baseline surveys will be undertaken.

Specific Methodologies

6.5.8.2 Impacts from construction activities, if scoped in, will be assessed semi-quantitatively using the methodology described in the IAQM guidance [37].

6.5.8.3 Impacts from flaring are expected to be limited to short term impacts. Depending on the expected flare volumes these may require dispersion modelling for detailed assessment.

Assessment Criteria

6.5.8.4 The assessment criteria to determine impacts from construction activities are described in the IAQM guidance [2].

6.6 Noise and Vibration

6.6.1 Introduction

6.6.1.1 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.

6.6.2 Topic-specific Regulatory Requirements and Guidance

6.6.2.1 The noise and vibration assessment will be carried out within the context of relevant government policy and guidance in England. This includes the NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4), Noise Policy Statement for England 2010[1] (NPSE), the NPPF 2019[2], and the Government's planning guidance on noise (PPGN)[3].

6.6.2.2 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;

[37] construction-dust-2014.pdf (iaqm.co.uk)

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

6.6.2.3 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.

6.6.2.4 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 6.12.

Table 6.12: 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 disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
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

Construction and Decommissioning Phases

6.6.2.5 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 (CoPA ,1974);
- The Environmental Protection Act 1990 (EPA, 1990); and
- BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

Operational Phase

6.6.2.6 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; and
- ISO 9613-2:1996: Attenuation of Sound during Propagation Outdoors.

6.6.3 Baseline Environment

Data Sources used in Scoping

6.6.3.1 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. The study area for the noise and vibration assessment is based on 2 km from the Scoping Boundary.

Description

6.6.3.2 The nearest noise sensitive receptor (NSRs) is within the Scoping Boundary 300m east of AGS. There are a number of residential properties within 2 km of the Hydrogen Storage Facility, with the closest town being Aldbrough, approximately 2 km north of the Hydrogen Storage Facility. A number of these residential properties are operational farms which may contribute to baseline noise levels. The nearest identified NSRs are shown in Figure 6.3. Their use as assessment locations would, at this stage, be expected to result in a worst-case assessment.

Scoping Boundary

Noise Sensitive Receptor

0 200 400 600 800 1,000

Metres

N

SCALE: See Scale Bar	VERSION: A03
SIZE: A4	DRAWN: GB/HD
PROJECT: 0630444	CHECKED: JH
DATE: 09/05/2023	APPROVED: ES

Figure 6.3
Nearest Identified Noise Sensitive Receptors

ERM

equinor

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - AC - Noise Sensitive Receptors - A03

6.6.3.3 The baseline noise environment is likely to include road traffic noise from the existing road network, AGS, which is directly north of the Scoping Boundary, 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.

Key Sensitivities

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

6.6.4 Project Basis for Scoping Assessment

Construction

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

- Fixed and mobile construction plant used to construct infrastructure within the Hydrogen Storage Facility will generate noise and vibration. Infrastructure involved will include the CPA, wellhead platform, a wellhead 'cellar' (below ground concrete structure), a hydrogen vent/flare and both access roads and laydown areas.
- A drilling rig will be required to access the salt layer. It is likely that drilling and the subsequent casing and cementing operations will need to be carried out continuously to avoid problems associated with the collapse of the well bore. Therefore night time works will be required as a result of this activity.
- Leaching activities to support the solution mining of the caverns will be required and therefore pumps will be used to move salt water. This will be a continuous operation (i.e. 24 hours a day).
- Occasional 'work-over' operations will be required for the wells. These will be similar to drilling operations but are likely to be lower in noise level as a smaller rig will be used and the rig will only run strings in and out of the well (rather than direct drilling).
- Onshore noise sensitive receptors may be affected by noise from offshore construction works near shore to install the pipelines such as cofferdam construction, marine trenching and pipe laying, should they be required. Near shore construction may need to be carried out when the tides allow and therefore some night working may be required.
- Construction traffic associated with the workforce and the delivery of material and equipment who will use the wider local road network.

Operation

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

- Operations at the CPA containing the gas handling plant with compression and gas drying facilities.
- Activities at the wellhead platform with associated facilities for all of the caverns.
- Rare use of the hydrogen vent / flare in the event of maintenance, abnormal conditions or emergencies.

6.6.5 Mitigation

Construction

6.6.5.1 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. BS5228-1 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.

6.6.5.2 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.

Operation

6.6.5.3 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.

6.6.6 Likely Significant Effects to be Considered in the EIA

6.6.6.1 Table 6.13 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.

6.6.6.2 As decommissioning will be more than 30 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.

Table 6.13: Likely Effects – Noise and Vibration

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction and decommissioning of infrastructure for the Hydrogen Storage Facility including the CPA	Practicable noise control measures, following the guidance set out in Section 8 of BS 5228-1	Medium	High	Moderate	Scoped In	Day / evening / night baseline measurements
Drilling of caverns		Medium	High	Moderate	Scoped In	
Solution mining		Small	High	Minor	Scoped In	
Offshore construction works near shore to install the pipelines		Medium	High	Moderate	Scoped In	
Construction road traffic		Small	High	Minor	Scoped In	Publicly available traffic data supplemented by traffic counts in some areas
Noise from the operation of the CPA	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	Small	High	Minor	Scoped In	Day / night baseline measurements
Operation of the wellhead and leaching area		Small	High	Minor	Scoped In	
Operation of the hydrogen vent / flare		Small	High	Minor	Scoped In	

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Operational road traffic	screening will be considered, where practicable.	Negligible	High	Not significant	Scoped Out	Publicly available traffic data supplemented by traffic counts in some areas
Vibration from the operation of the Hydrogen Storage Facility	n/a	Negligible	High	Not significant	Scoped Out	n/a

6.6.7 Effects Scoped out of the EIA

6.6.7.1 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).

6.6.7.2 Significant increases in road traffic noise during operation are not expected to occur and are therefore scoped out of further assessment.

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

6.6.7.4 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.

6.6.8 Proposed Approach to the Assessment

Baseline

6.6.8.1 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.

6.6.8.2 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.

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

6.6.8.4 Potential construction 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 allow a conservative assessment to be carried out, however, additional traffic counts may be carried out in some areas to supplement this information.

Specific Methodologies

6.6.8.5 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 [6]. Construction noise level predictions would be carried out according to BS 5228-1[4].

Assessment Criteria

6.6.8.6 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.

Construction and Decommissioning Phases

6.6.8.7 Construction noise will be assessed using BS 5228-1[4], 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 6.14**.**

6.6.8.8 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 6.12**).**

6.6.8.9 For daytime, the widely used threshold of 75 dB L_{Aeq} (category C) being exceeded for one month or more will 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 [5]). The daytime SOAEL and the corresponding SOAELs for the evening and night periods (shown in Table 6.14), indicate likely significant effects on health and quality of life at a receptor, assuming construction noise is dominant and of sufficient duration.

Table 6.14: Airborne Sound from Construction – Impact Criteria at Residential Receptors

Period	Assessment Category dB $L_{Aeq, T}$		
	A	B	C (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.

6.6.8.10 Where predicted noise levels are above LOAEL thresholds, but below the SOAEL, other factors will 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 6.15.

Table 6.15: 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

6.6.8.11 Construction traffic noise has been predicted in terms of the Basic Noise Level (BNL), according to CRTN[38]. 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 Design Manual for Roads and Bridges (DMRB). If construction traffic noise is above a Small magnitude, the effect will be considered significant if it lasted for at least 10 or more days or nights in any 15 consecutive days or nights.

Operational Phase

6.6.8.12 The potential for significant noise effects will be assessed according to BS 4142:2014 +A1: 2019 [7]. 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.

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

- Specific sound level, L_s ($L_{Aeq,Tr}$): 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, L_a ($L_{Aeq,T}$): the overall sound level from all sources, usually composed of sound from many sources near and far;
- Residual sound level, L_r ($L_{Aeq,T}$): 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

6.6.8.14 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'.

6.6.8.15 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*."

6.6.8.16 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

[38] Calculation of Road Traffic Noise. Department or Transport Welsh Office. HMSO 1998

- other sound characteristics (neither tonal nor impulsive but still distinctive): a +3 dB penalty.

Consideration of Context

6.6.8.17 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*."

6.6.8.18 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.

6.6.8.19 Table 6.16 summarises the criteria for the magnitude and significance of potential effects as well as the LOAEL and SOAEL values.

Table 6.16: Criteria Defining the Magnitude and Significance of Potential Effects from Fixed Plant

Noise Rating level (1), $L_{Ar,Tr}$	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

1) Rating Level, LAr,Tr according to BS 4142. The specific sound level corrected to allow for certain distinctive acoustic features.
2) Background Sound Level according to BS 4142. The measured L_{90} level in the absence of the specific level.

6.6.8.20 Operational traffic noise has been predicted in terms of the Basic Noise Level (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.

6.7 Ecology and Nature Conservation

6.7.1 Introduction

6.7.1.1 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 including marine mammals, fish and shellfish and benthic and intertidal ecology are considered in **Chapter 7.**

6.7.2 Topic-specific Regulatory Requirements and Guidance

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

- NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4).
- Directive 2009/147/EC on the Conservation of Wild Birds ('Birds Directive')[39];
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) ('Habitats Directive')[40];
- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (as amended) ('Habitat Regulations')[41];
- The Wildlife and Countryside Act 1981 (as amended)[42];
- The Natural Environment and Rural Communities (NERC) Act 2006[43];
- Environmental Impact Assessment Directive 2014/52/EU[44];
- UK Post-2010 Biodiversity Framework (2012)[45];
- NPPF[46];

[39] The Bird Directive. Available from: https://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

[40] European Parliament (1992) Directive 92/43/EEC [Online] Available from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN

[41] The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 [Online] Available from: https://www.legislation.gov.uk/ukdsi/2019/9780111179512/contents

[42] The Wildlife and Countryside Act 1981 (as amended). Available from: http://www.legislation.gov.uk/ukpga/1981/69

[43] Natural Environment and Rural Communities Act 2006. Available from: http://www.legislation.gov.uk/ukpga/2006/16/contents

[44] European Parliament (2014) Directive 2014/52/EU [Online] Available from: https://eur-lex.europa.eu/legal content/EN/TXT/?uri=CELEX:32014L0052

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

[46] Gov.uk National Policy Planning Framework 2021 [online] Available from: https://www.gov.uk/government/publications/national-planning-policy-framework—2

- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Chartered Institute of Ecology and Environmental Management (CIEEM),2019[47];
- East Riding Local Plan[48];
- East Riding of Yorkshire Biodiversity Action Plan[49]; and
- Birds of Conservation Concern (BoCC) 5: the population status of birds in the United Kingdom, Channel Islands and Isle of Man[50].

6.7.3 Baseline Environment

Data Sources used in Scoping

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

Description

Statutory Designated Sites

6.7.3.1 There are three International/European and national statutory designated sites within 5 km of the Hydrogen Storage Facility. The full list of statutory designated sites, along with a brief description of their interest features is given in Table 6.17 and shown on Figure 6.4. The Humber Estuary SAC/SPA/Ramsar/SSSI lies 12.4 km south-west of the Hydrogen Storage Facility. Due to its international importance and mobile qualifying species (birds), this site is also considered in the scoping assessment and HRA (see **Section 2.2.3).** There are no SACs with bats as qualifying features within 30 km of the Hydrogen Storage Facility.

Non-Statutory Designated Sites

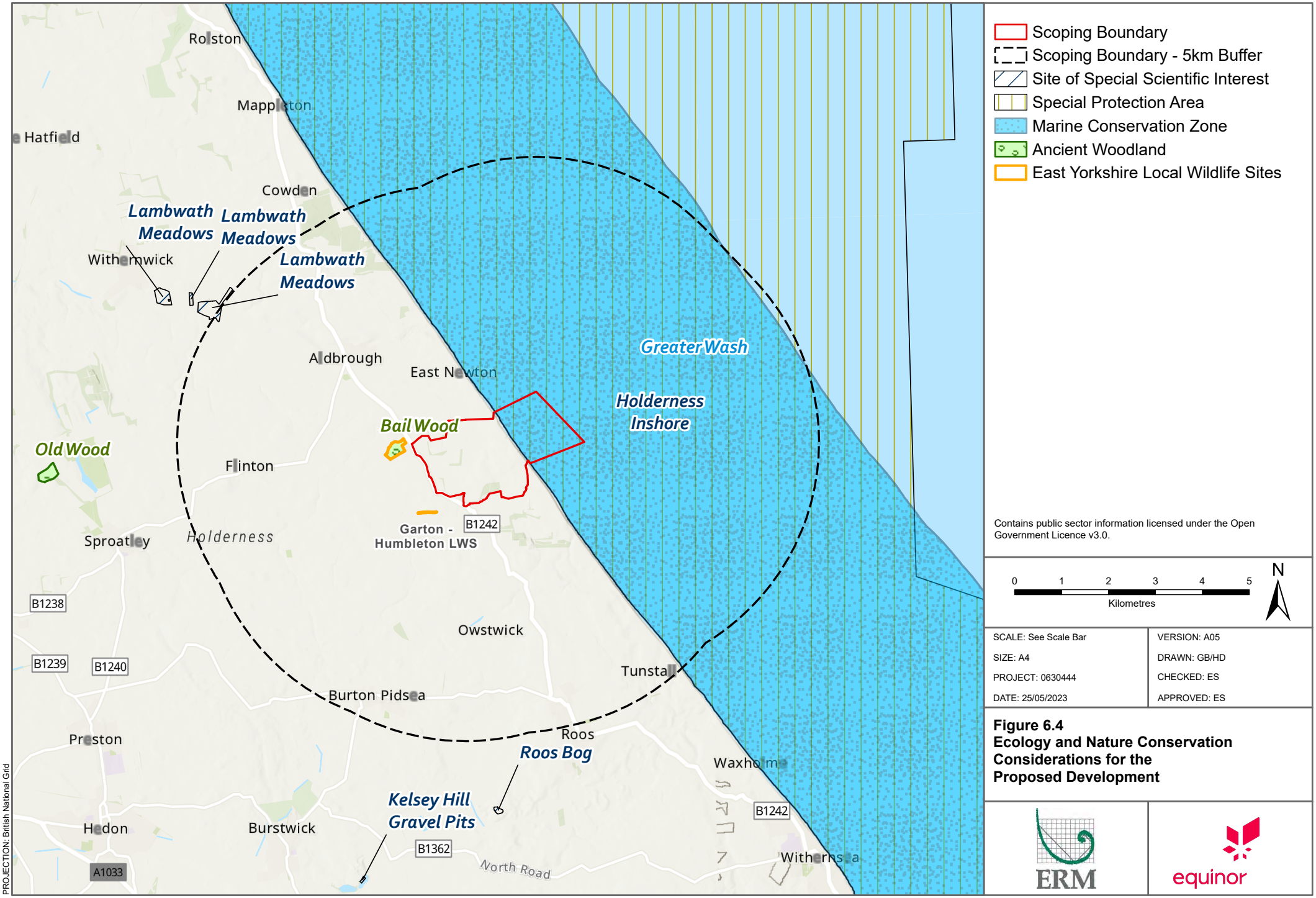
6.7.3.2 Bail Wood Ancient Woodland and LWS is located approximately 115 m west of the Hydrogen Storage Facility. The Garton-Humbleton LWS is located 400 m south-west of the Hydrogen Storage Facility. Further details are provided in Table 6.17 and shown on Figure 6.4.

[47] 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

[48] Available online at: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/east-riding-local-plan/

[49] Available online at: https://www.eastriding.gov.uk/EasySiteWeb/GatewayLink.aspx?alId=105217

[50] 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


Scoping Boundary
Scoping Boundary - 5km Buffer
Site of Special Scientific Interest
Special Protection Area
Marine Conservation Zone
Ancient Woodland
East Yorkshire Local Wildlife Sites
Ro ston
Mappleton
e Hatfield
Cowden
Lambwath Meadows
Lambwath Meadows
Lambwath Meadows
Withernwick
Aldbrough
East Newton
Greater Wash
Holderness Inshore
Bail Wood
Old Wood
Flinton
Garton - Humbleton LWS
B1242
Sproatley
Holderness
B1238
B1239
B1240
Owstwick
Tunstall
Burton Pidsea
Roos
Roos Bog
Pr ston
Waxholme
Kelsey Hill Gravel Pits
B1242
H don
Burstwick
B1362
North Road
Withernsea
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Contains public sector information licensed under the Open Government Licence v3.0.
0 1 2 3 4 5
Kilometres
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SCALE: See Scale Bar
VERSION: A05
SIZE: A4
DRAWN: GB/HD
PROJECT: 0630444
CHECKED: ES
DATE: 25/05/2023
APPROVED: ES
Figure 6.4
Ecology and Nature Conservation Considerations for the Proposed Development
ERM
equinor
PROJECTION: British National Grid
Esri, Intermap, NASA, NGA, USGS, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Natural England
Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - EC - Environmental Constraint 5km - A05

Table 6.17: Statutory and non-statutory sites within 5km of the Proposed Development

Designated Site	Distance from Hydrogen Storage Facility	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	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 and LWS	115 m north-west	Only boundary information held.
Garton-Humbleton LWS	400 m south-west	No information provided on citations, species lists or maps. Only boundary information held.

6.7.3.3 The Hydrogen Storage Facility is predominantly under arable land use, with some broad-leaved plantation woodland, grassland, wetland, scrub and numerous dry ditches present. The East Newton Drain forms the northern boundary of the Hydrogen Storage Facility and there are some standing water features which were dry when the Phase 1 habitat survey was undertaken in May 2022. Areas within the Hydrogen Storage Facility Scoping Boundary which could not be accessed will be assessed in May 2023.

6.7.3.4 The construction works are likely to take place across grassland and wetland habitats which have some ecological value and the potential to support protected species.

6.7.3.5 An application has been made to United Nations Educational, Scientific and Cultural Organization (UNESCO) for the inclusion of "East Atlantic Flyway – England East Coast Wetlands" on the UNESCO World Heritage Site (WHS) list. The areas proposed for inclusion are located south of the Proposed Development. The potential inclusion of this WHS site will be taken into consideration in the ecological impact assessment (EcIA).

Key Sensitivities

6.7.3.6 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 grassland habitats, including temporary disturbance to ditches, which could be vulnerable from impacts during the construction stage.

6.7.4 Project Basis for Scoping Assessment

Construction

6.7.4.1 The construction of the Proposed Development will result in the loss of terrestrial habitats, 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 as set out in **Section 2.2.3**.

6.7.4.2 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.

Operation

6.7.4.3 The operation of the Hydrogen Storage Facility could result in the disturbance and displacement of species which use the Hydrogen Storage Facility 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.

6.7.4.4 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 Hydrogen Storage Facility.

6.7.5 Mitigation

6.7.5.1 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 CEMP.

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

6.7.6 Likely Significant Effects to be Considered in the EIA

6.7.6.1 Ecological surveys are currently ongoing (started May 2022) at the Hydrogen Storage Facility and the completion of surveys is expected October 2023. Taking into consideration the surveys and assessments undertaken to date, the following points are relevant:

- **Designated sites**: there are multiple international/national designated sites that the Hydrogen Storage Facility have the potential to interact with. The EcIA and HRA processes will identify any likely significant effects on these sites.
- **Bats:** the Hydrogen Storage Facility area provides moderate suitability for foraging and commuting bats; there is no habitat suitable for roosting bats. Surveys are currently ongoing and following their completion the assessment on this species can be undertaken.
- **Badgers (*Meles meles*)**: no evidence of badgers was identified during the surveys at the Hydrogen Storage Facility; 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 both the Hydrogen Storage Facility.
- **Birds:** the habitats within the Hydrogen Storage Facility has 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 Hydrogen Storage Facility. These include protected and sensitive species such as barn owl. Wintering and passage bird surveys commenced in autumn 2022; the findings of which will determine the level of use of these habitats by SPA qualifying interest species and birds of conservation value/protection using this area over winter.
- **Great Crested Newts (*Triturus cristatus*) (GCN):** only one pond within 500 m of the Hydrogen Storage Facility could be accessed for survey. The eDNA surveys were negative for GCN. Further surveys of other suitable ponds in the potential area of effect will be undertaken to confirm the status of GCN in the area and to assess the impacts if their presence is confirmed.
- **Water Vole (*Arvicola amphibius*) and Otter (*Lutra lutra*):** habitats at the Hydrogen Storage Facility are suitable for water vole. A single survey undertaken at the Hydrogen Storage Facility in July 2022 identified possible water vole burrows. As a result of this finding, an additional survey to confirm the presence or absence was undertaken in September 2022 and no signs of water vole were found.

6.7.7 Effects Scoped out of the EIA

6.7.7.1 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).

6.7.7.2 Dormice have been scoped out of further assessment since the background data search indicated that dormice are considered absent from the county of East Riding of Yorkshire.

6.7.7.3 White-clawed Crayfish (*Austropotamobius pallipes*) have also been scoped out as ditches at the Hydrogen Storage Facility are unsuitable habitat.

6.7.8 Proposed Approach to the Assessment

Baseline Habitat Survey of the Hydrogen Storage Facility

6.7.8.1 A Phase 1 Habitat survey was undertaken by ERM in May 2022 which will be updated in 2023 to allow for variations in the Scoping Boundary. The Hydrogen Storage Facility 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.

Species Surveys of the Hydrogen Storage Facility

6.7.8.2 A number of specific surveys for protected species were undertaken in 2022 and the early part of 2023, with further surveys planned for the remainder of 2023.

Badgers

6.7.8.3 During the Phase 1 Habitat Surveys, a walkover survey for badgers was also undertaken. Areas within the Hydrogen Storage Facility are of suitable sett building habitat however, no active setts or evidence of badgers were identified during the survey. Additional badger surveys will be undertaken in 2023 to cover the new areas following the variations in Scoping Boundary.

Bats

6.7.8.4 The 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 woodlands and hedgerows at the Hydrogen Storage Facility are of moderate suitability for foraging and commuting bats. A series of transect surveys and static detector monitoring surveys began in May 2022 and were completed in April 2023. These surveys were undertaken as per the Bat Conservation Trust (BCT) guidance[51].

Birds

6.7.8.5 Woodland, trees and grassland within the Hydrogen Storage Facility provide suitable habitat for breeding birds. The arable fields and beach also provide suitable overwintering habitat for birds. The Hydrogen Storage Facility is close to the Greater Wash SPA which is designated for its bird assemblages.

6.7.8.6 A series of three surveys between March and June 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. Barn owl hunts the grassland both along the western bunds and near Garton, where there is suitable breeding habitat.

6.7.8.7 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.

6.7.8.8 Wintering bird surveys were undertaken at the Hydrogen Storage Facility and surrounding area including the coastline from October 2022 to March 2023.Passage bird surveys were undertaken in April. There will be a second passage bird survey undertaken in September 2023 as this was not completed in 2022.

[51] Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines. 3rd edition. Bat Conservation Trust, London

6.7.8.9 Wintering bird survey data indicates that in the clifftop fields / intertidal areas, red-throated diver, cormorants, gulls, golden plover and skylark were recorded. Around the Hydrogen Storage Facility, lapwing, yellowhammer, reed bunting were noted as being present. The field (flooded in late winter / spring) south of the Hydrogen Storage Facility, supported several species of conservation concern including jack snipe and snipe. Meadow pipits also wintered in these fields along with mallard and teal as the fields flooded.

6.7.8.10 Along the inland transect, away from the Hydrogen Storage Facility, skylark, tree sparrows, common gulls were recorded. Other gull species included black-headed, Mediterranean, herring, yellow-legged and lesser black-backed. Golden plover, pink-footed geese, lapwing and curlew were also recorded within the transect.

6.7.8.11 Passage bird survey data indicates that in the clifftop fields / intertidal areas, little gull, passerine migrants (mostly thrushes and starlings), snow bunting, lapland bunting, peregrines, merlins, short-eared owl, migrating wildfowl and waders, wigeon, teal, pink-footed geese, grey plovers, gulls and red-throated divers were recorded in Autumn and Spring. Spring passage increased in March, with large numbers of passerines moving along the clifftop including peregrines, finches, thrushes, corn bunting, common scoter, sand martin and marsh harrier.

6.7.8.12 Passage was fairly limited on the inland transect due to the Holderness coastline concentrating migrating birds. Mediterranean, yellow-legged and lesser black-backed gull and a kittiwake were recorded.

Great Crested Newts

6.7.8.13 At the time of the survey there were eight ponds within 500 m of the Hydrogen Storage Facility. Of these ponds, three were within the area in which surveyors had access, two of these were dry. The one pond within the accessible area, which appeared suitable for GCN was in St Michaels Wood. An eDNA survey was undertaken on this pond however the results were negative. There are no GCN records within 1 km of the Hydrogen Storage Facility. Following variations in the Scoping Boundary a further four ponds are now within 500 m of the Hydrogen Storage Facility.

6.7.8.14 Due to access limitation not all the ponds within 500 m could be assessed for GCN. eDNA surveys will be undertaken to confirm presence or absence of newts once access is permitted.

Reptiles

6.7.8.15 Areas of grassland, scrub, woodland edges and bare ground within the Hydrogen Storage Facility provide suitable habitat for reptiles. There are also several rubble piles and what appears to be manmade hibernacula within the Hydrogen Storage Facility. There are records of grass snake (Natrix natrix) within 1 km of the Hydrogen Storage Facility.

6.7.8.16 Detailed reptile surveys were undertaken on the Hydrogen Storage Facility in September 2022. No evidence of reptiles was recorded over the course of the surveys, it is therefore unlikely that reptiles are present in the survey area and no further actions with regards to reptiles are required.

Water Vole and Otter

6.7.8.17 There are water vole records within 1 km of the Hydrogen Storage Facility but no records of otter. A water vole survey was undertaken in July 2022 along East Newton Drain and two potential burrows were identified. A further survey was undertaken in September 2022 to confirm the presence/absence of water voles. No further evidence of water vole was identified during the survey in September 2022, as burrows alone cannot reliably establish the presence of water voles their presence could not be confirmed within East Newton

Drain. However, due to the limited accessibility of the watercourse and the dense vegetation present during both surveys a precautionary approach will be implemented regarding water vole. No evidence of otter was observed during either survey.

Specific Methodologies

6.7.8.18 Survey methodologies have been/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 & 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. & 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.

Assessment Criteria

Methodology

6.7.8.19 The approach taken for the assessment of ecological effects will follow the CIEEM Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland[52]. 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.

6.7.8.20 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

6.7.8.21 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.

6.7.8.22 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 Proposed Development use with potential to impact habitats and protected species.

6.7.8.23 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

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

[52] 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

- 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.

6.7.8.25 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

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

6.7.8.27 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"; and
- 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)."

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

6.8 Landscape and Visual Assessment

6.8.1 Introduction

6.8.1.1 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 assessment of seascape is considered in **Section 7.9**.

6.8.1.2 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.

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

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

6.8.2 Topic-specific Regulatory Requirements and Guidance

6.8.2.1 Paragraph 174, of the National Planning Policy Framework 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)".*

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

- NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4);
- Landscape Institute/ Institute of Environmental Management and Assessment (2013), 'Guidelines for Landscape and Visual Impact Assessment', 3rd Edition ('GLVIA3')[53];
- Landscape Institute (2013), GLVIA3 Statement of Clarification 1/13[54];
- Landscape Institute (2019), 'Visual Representation of Development Proposals', Technical Guidance Note[55];
- Landscape Institute (2021), Technical Guidance Note 02/21 Assessing landscape value outside national designations [56];
- Natural England and DEFRA (2014) Landscape and Seascape Character Assessments[55]; and
- Natural England (2014) An Approach to Landscape Character Assessment[56]

6.8.3 Baseline Environment

Data Sources used in Scoping

6.8.3.2 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:

[53] Landscape Institute and Institute of Environmental Management and Assessment, 2013, *Guidelines for Landscape and Visual Impact Assessment*, 3rd Edition, Routledge, London.

[54] The Landscape Institute (2015) GLVIA3 – Statements of Clarification. Available online at: https://www.landscapeinstitute.org/technical-resource/glvia3-clarifications/ (Accessed 07/02/2022))

[55] The Landscape Institute, *Visual Representation of Development Proposals, Technical Guidance Note 06/19*, 17th September 2019.

[56] Landscape Institute (2021). Technical Guidance Note 02/21 Assessing landscape value outside national designations.

- Natural England (September 2014) National Character Area Profiles;
- East Riding of Yorkshire Landscape Character Assessment Update (2018);
- East Riding of Yorkshire Local Plan (April 2016);
- OS mapping at 1:50,000, 1:25,000 and 1:10,000;
- aerial photography; and
- Google Earth, Street View and Maps.

Description

6.8.3.3 The Hydrogen Storage Facility lies entirely within an earth bund that is well vegetated, created as part of AGS, in an otherwise agricultural 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.

6.8.3.4 The Hydrogen Storage Facility lies within a rural area with occasional manmade / industrial features, including AGS, which are large scale features within the landscape. The topography of the Hydrogen Storage Facility varies from 15 m above ordnance datum (AOD) to 25 m AOD to the south-east with the surrounding area being relatively low-lying.

6.8.3.5 Withernwick Wind Farm, which comprises nine turbines, is situated 4 km north-west of the Hydrogen Storage Facility. In addition, four turbines lie immediately north of Cowden Lane, forming the 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 north of the Proposed Development.

Landscape Character

6.8.3.6 The Hydrogen Storage Facility 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.

6.8.3.7 At a local level, the East Riding of Yorkshire Landscape Character Assessment Update (2018)[57] divides the landscape of the county into 23 Landscape Character Types (LCTs). These have been refined further into 81 Landscape Character Areas (LCAs). The Hydrogen Storage Facility is predominantly situated within LCT 20: Coastal Farmland and LCA 20B: Hornsea to Withernsea Coast.

6.8.3.8 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.

6.8.3.9 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.

[57] 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/

6.8.3.10 The western extent of the Hydrogen Storage Facility 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.

6.8.3.11 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'.

6.8.3.12 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

6.8.3.13 There are no statutory landscape designations (National Parks or Areas of Outstanding Natural Beauty (AONB)) within the boundary of the Hydrogen Storage Facility or within a 20 km radius. The nearest is the Lincolnshire Wolds AONB, approximately 30 km south of the Hydrogen Storage Facility.

6.8.3.14 The adopted East Riding Local Plan (2016) identifies 'Important Landscape Areas', as locally designated non-statutory designations within Policy ENV2: Promoting a High Quality Landscape. However, the Hydrogen Storage Facility is not included within this local designation, located approximately 23.7 km east (at its nearest extent) from land lying within the Yorkshire Wolds.

Visual Receptors and Visual Amenity

6.8.3.15 Visual effects will be experienced by the people who live and work in the area, along 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 what they are doing at those places. This includes residents within settlements, users of the local transport network and Public Rights of Way (PRoW) as well as people visiting local areas of interest.

Residential Receptors

6.8.3.16 The pattern of settlement within the vicinity of the Hydrogen Storage Facility 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 Hydrogen Storage Facility would potentially be afforded from these locations. There are some larger settlements in the wider area. Closer to the Hydrogen Storage Facility receptors are present in villages, including Humbleton and Burstwick.

Recreational Receptors

6.8.3.17 Users of the local PRoW network are 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, although there is no formal access to the beach in the area close to the Hydrogen Storage Facility.

Transport Routes

6.8.3.18 There is a network of local, rural roads within the vicinity of the Hydrogen Storage Facility, 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.

Study Area

6.8.3.19 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 Hydrogen Storage Facility Boundary. This study area extent will be used for the examination of effects on landscape character and views / visual amenity.

6.8.3.20 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 Hydrogen Storage Facility based on upper height limits as established in parameter plans. The ZTV will take account of existing screening provided by woodland and earth bunds.

Representative viewpoints

6.8.3.21 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 (VP) selection has followed good practice guidance and in particular paragraphs 6.18 to 6.20 within GLVIA3.

6.8.3.22 A list of proposed viewpoints for the assessment is set out in Table 6.18 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 6.18: Representative Viewpoints

Viewpoint number	Viewpoint location	X	Y	Approximate distance from the Site
VP1	View looking west from Aldbrough Bridleway No. 16	526998	436835	300m
VP2	View looking north-east from East Garton Footpath No. 2	525109	435997	1.1 km
VP3	View looking south-west from Aldbrough Sands	526798	438083	1.1 km
VP4	View looking south-east from Willow Grove, Aldbrough	524324	438370	2 km
VP5	View looking north from the B1242 Aldbrough Road, Garton	526357	435548	1.3 km

6.8.3.23 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.

Key Sensitivities

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

- potential direct and indirect landscape effects on effects on local landscape character, including cumulative effects, particularly on the host LCTs / LCAs;
- views from key visual receptors including from key routes and settlements and nearby individual properties;
- views from recreational areas and routes; and
- views experienced by users of the main and local road network.

6.8.4 Project Basis for Scoping Assessment

6.8.4.1 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 Hydrogen Storage Facility;
- construction of sub-surface infrastructure of the Hydrogen Storage Facility;
- presence of the drilling rig;
- operation of the Hydrogen Storage Facility; and
- decommissioning of the Hydrogen Storage Facility.

6.8.5 Mitigation

6.8.5.1 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, PRoWs, 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.

6.8.5.2 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.

6.8.5.3 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 all existing hedgerows and trees within 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);
- replacing existing arable uses across the Proposed Development with species-rich grassland / wildflower meadows to improve the biodiversity value of the Proposed Development; and
- improving the management of existing vegetation, watercourses, and any ponds at the Proposed Development.

6.8.5.4 Overall, mitigation measures incorporated with the Proposed Development will be required to achieve a 10% biodiversity net gain (BNG).

6.8.6 Likely Significant Effects to be Considered in the EIA

6.8.6.1 Table 6.19 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.

6.8.6.2 As decommissioning will be more than 30 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.

Table 6.19: Likely Effects - LVIA

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction of surface infrastructure for the Hydrogen Storage Facility	Existing bund / screening measures	Large	Low - Medium	Overall, the effects of construction on landscape resources will be restricted to small geographical areas within the Hydrogen Storage Facility 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 and localised, resulting in no meaningful influence on the local landscape character beyond the Hydrogen Storage Facility itself.	Scoped In. The visual effects of the Hydrogen Storage Facility during the construction period will 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 track 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.
Construction of the wet well	Temporary bund / screening measures	Large	Low - Medium	Overall, the effects of construction on landscape resources will be restricted to small geographical areas within the wet well 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 and localised, resulting in no meaningful influence on the local landscape character beyond the wet well itself.	Scoped In. The visual effects of the wet well 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 track 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.

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Drilling for the subsurface infrastructure	Existing bund / screening measures	Small - Medium	Low - Medium	Overall, the effects of construction on landscape resources will be restricted to small geographical areas within the Hydrogen Storage Facility and are unlikely to result in the removal of any important or unusual landscape features. The effects will be of short duration, temporary in nature and localised, resulting in no meaningful influence on the local landscape character beyond the Hydrogen Storage Facility itself.	Scoped In. The visual effects of the Hydrogen Storage Facility during the construction period will 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 track 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.
Construction of sub-surface infrastructure	Existing bund / screening measures	Large	Low - Medium			Construction phase programme and proposed design.
Operation of Hydrogen Storage Facility	The landscape and visual objectives of the embedded mitigation are: • to screen elements of the Hydrogen Storage Facility from key receptor locations, e.g. nearby residential properties;	Large	Low - Medium	Compared to the construction phase, the Hydrogen Storage Facility would gain a more 'settled' appearance during the operational period when construction activity ceases. The Hydrogen Storage Facility will be visible over a limited area with potential for indirect effects on the surrounding landscape and surrounding visual receptors. There is potential for flaring, if used, to have effects on views experienced at night, unless a ground flare is proposed.	Scoped In	

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
	• to soften 'hard edges' of the Hydrogen Storage Facility from PRoW; and • to reflect existing landscape elements – such as the bund, and character in areas of the wider landscape setting.					
Decommissioning of the Hydrogen Storage Facility	No specific mitigation measures proposed	Large	Low – Medium	Overall, the effects of decommissioning phase on landscape resources will be restricted to small geographical areas within the Hydrogen Storage Facility. The effects will be of short duration, temporary in nature and localised, resulting in no meaningful influence on the local landscape character beyond the Hydrogen Storage Facility itself.	Scoped In. Potential landscape and visual effects at this stage will 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 Hydrogen Storage Facility which could result in landscape and visual effects during the decommissioning period.	Decommissioning phase programme

6.8.7 Effects Scoped out of the EIA

6.8.7.1 Whilst 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).

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

- LCTs / LCAs located beyond 2.5 km radius around the Hydrogen Storage Facility boundary;
- LCTs / LCAs within 2.5 km radius around the Hydrogen Storage Facility boundary but which do not fall within the ZTV output;
- visual effects on visual receptors beyond 2.5 km of Hydrogen Storage Facility boundary or those locations judged to have limited or no visibility of the Proposed Development following the results of the ZTV and verification on site.

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

6.8.8 Proposed Approach to the Assessment

Specific Methodologies

6.8.8.1 The two components of LVIA are based on the following definitions[58]:

- '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.'

6.8.8.2 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.

6.8.8.3 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

[58] Landscape Institute and Institute of Environmental Management and Assessment, 2013, *Guidelines for Landscape and Visual Impact Assessment*, 3rd Edition, Routledge, London.

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.

6.8.8.4 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;
- 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.

6.8.8.5 Particular attention will be dedicated to the Proposed Development's impact on local residents because since will experience the Proposed Development from different locations, at different times of the day, usually for longer periods of time, and in different seasons.

Visualisations

6.8.8.6 Annotated baseline photographs to reflect the maximum likely parameters of the Proposed Development, including its potential extent and location in each view, will 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.

Cumulative Assessment

6.8.8.7 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 Hydrogen Storage Facility in conjunction with other planned infrastructure development in the vicinity.

6.8.8.8 An assessment of the cumulative effects with existing infrastructure development will be undertaken in line with GLVIA3,

Assessment Criteria

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

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

6.8.8.10 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 6.20. 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 involves 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.

6.8.8.11 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 6.20 below).

Table 6.20: 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

6.9 Historic Environment

6.9.1 Introduction

6.9.1.1 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.

6.9.2 Topic-specific Regulatory Requirements and Guidance

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

- NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4).
- Ancient Monuments and Archaeological Areas Act 1979 (amended by the National Heritage Act 1983 and 2003);

- NPPF (Section 16 - Conserving and enhancing the historic environment) (2012, revised 2021)[59];
- Planning (Listed Buildings and Conservation Areas) Act 1990 (amended by the Enterprise and Regulatory Reform Act 2013); and
- Planning Practice Guidance (PPG) – Historic Environment provide up to date policy with regard to the assessment of harm to heritage assets.

6.9.2.2 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)[60];
- Chartered Institute for Archaeologists (CIfA) (2020) Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment[61];
- English Heritage (2008) Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment[62];
- Hedgerow Regulations 2019 (As Amended)[63];
- Historic England (2015) Historic Environment Good Practice Advice in Planning Note 2: Managing Significance in Decision-Taking in the Historic Environment[64];
- Historic England (revised 2017) Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets[65]; and
- Historic England (2016) Preserving Archaeological Remains Decision-taking for Sites under Development[66].

[59] UK Government (2021) National Planning Policy Framework (Online) https://www.gov.uk/government/publications/national-planning-policy-framework--2 (Accessed 20/09/2021)

[60] Chartered Institute for Archaeologists (2014). *Standard and guidance for historic environment desk-based assessment.* Available at: CIfAS&GDBA_2.pdf (archaeologists.net)

[61] CIfA (2020) Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment [Online] https://www.archaeologists.net/sites/default/files/CIfAS%26GCommissioning_2.pdf (Accessed 20/09/2021)

[62] English Heritage (2008) Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment [Online] https://historicengland.org.uk/images-books/publications/conservation-principles-sustainable-management-historic-environment/conservationprinciplespoliciesandguidanceapril08web/ (Accessed 20/09/2021)

[63] Hedgerow Regulations 2002 (As Amended) [Online] https://www.gov.uk/guidance/countryside-hedgerows-regulation-and-management (Accessed 20/09/2021)

[64] Historic England (2015) Historic Environment Good Practice Advice in Planning Note 2: Managing Significance in Decision-Taking in the Historic Environment [Online] https://historicengland.org.uk/images-books/publications/gpa2-managing-significance-in-decision-taking/gpa2/ (Accessed 20/09/2021)

[65] Historic England (revised 2017) Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets [Online] https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/heag180-gpa3-setting-heritage-assets/ (Accessed 20/09/2021)

[66] Historic England (2016) Preserving Archaeological Remains Decision-taking for Sites under Development [Online] https://historicengland.org.uk/images-books/publications/preserving-archaeological-remains/heag100a-preserving-archaeological-remains/ (Accessed 20/09/2021)

6.9.3 Baseline Environment

Data Sources used in Scoping

6.9.3.1 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;
- The Humber Archaeology Partnership Historic Environmental Record (HHER)[67];
- 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.

Description

6.9.3.2 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 [68]. Mesolithic occupation in the southern part of Holderness is less well documented and until recently the record was limited to isolated scatters and findspots. Recent work on the Essington to Ganstead National Grid Pipeline Scheme has shown that this paucity of evidence is more likely to represent the coverage of previous research and the focus on the larger meres in the north of Holderness. At Sproatley, only 7 kms west of the Proposed Development, a well preserved settlement was excavated ahead of the pipeline consisting of a large flint working area, with associated animal bone, hazelnut shells and charcoal fragments, thought to be the remains of a series of short-lived encampments, and dated to between 8600-8000 cal. BC. The site was found on a discrete sand deposit next to a former channel that would have provided drier elevated ground above the lower lying marshes and streams[69].

6.9.3.3 Fieldwalking ahead of the construction of AGS identified struck flint artefacts that may be Mesolithic in the centre of the area proposed for the CPA indicating there is potential for buried remains from this period to survive within the scoping boundary[70]. Understanding the depth and nature of alluvial deposits such as those associated next to the Newton Farm Drain, in addition to undertaking more extensive fieldwalking will be crucial to assessing the potential for buried Mesolithic archaeology within the Scoping Boundary.

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[67]Humber Archaeology Partnership, The Old School, Northumberland Avenue, Hull, HU2 0LN: https://www.hull.gov.uk/environment/environment/humber-historic-environment-record

[68] The earliest securely dated evidence of human occupation in East Yorkshire comes from Gransmoor,, 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.

[69] Glover, G., Flintoft, P., & Moore, R. (Eds.) (2016). 'A Mersshy Contree Called Holdernesse': Excavations on the Route of a National Grid Pipeline in Holderness, East Yorkshire: Rural Life in the Claylands to the East of the Yorkshire Wolds, from the Mesolithic to the Iron Age and Roman Periods, and beyond. Archaeopress Publishing Ltd.

[70] Network Archaeology (1998). Aldbrough Gas Storage Facility: Archaeological Desk-Based Assessment, Reconnaissance Survey, Auger Survey and Geophysical Suvey.

6.9.3.4 Much of the evidence for Neolithic and Bronze Age settlement also comes from flint findspots and scatters in ploughed fields. A number of likely Bronze Age barrows are however known from the area, including one located less than 500m south-west of the Scoping Boundary, and a cluster of sites approximately 4 km to the south-west. 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. Fieldwalking ahead of the construction of AGS identified struck flint artefacts likely to be Neolithic and/or Bronze Age in the centre of the area proposed for the CPA indicating there is potential for buried remains to survive within the Scoping Boundary.

6.9.3.5 Similarly, the Iron Age occupation of the wider East Riding region has been well known for decades but little had been known about the central Holderness coastal plain itself. Recent development led archaeology over the last two decades, including within and adjacent to the Hydrogen Storage Facility Scoping Boundary (Figure 6.5) 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, including two locations that are within the Scoping Boundary (see below, this section). 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 within the Scoping Boundary has been interpreted as possible remains of one of these sites[71].

6.9.3.6 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 two sites within the southern edge of the current Scoping Boundary: the deserted medieval village (DMV), known as Grimston, in the location named ‘Old Garths’ on modern OS maps and extending west towards St Michael’s Church, and the medieval to post medieval settlement and shrunken medieval village (SMV) located on the western side of St Michaels Church (Figure 6.5).

6.9.3.7 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, including within the current Scoping Boundary. 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 on the very eastern side of the Scoping Boundary[72] was used for this purpose from at least the beginning of the 19th century and possibly earlier (Figure 6.5**)**. 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 instalment can be found[73]. 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

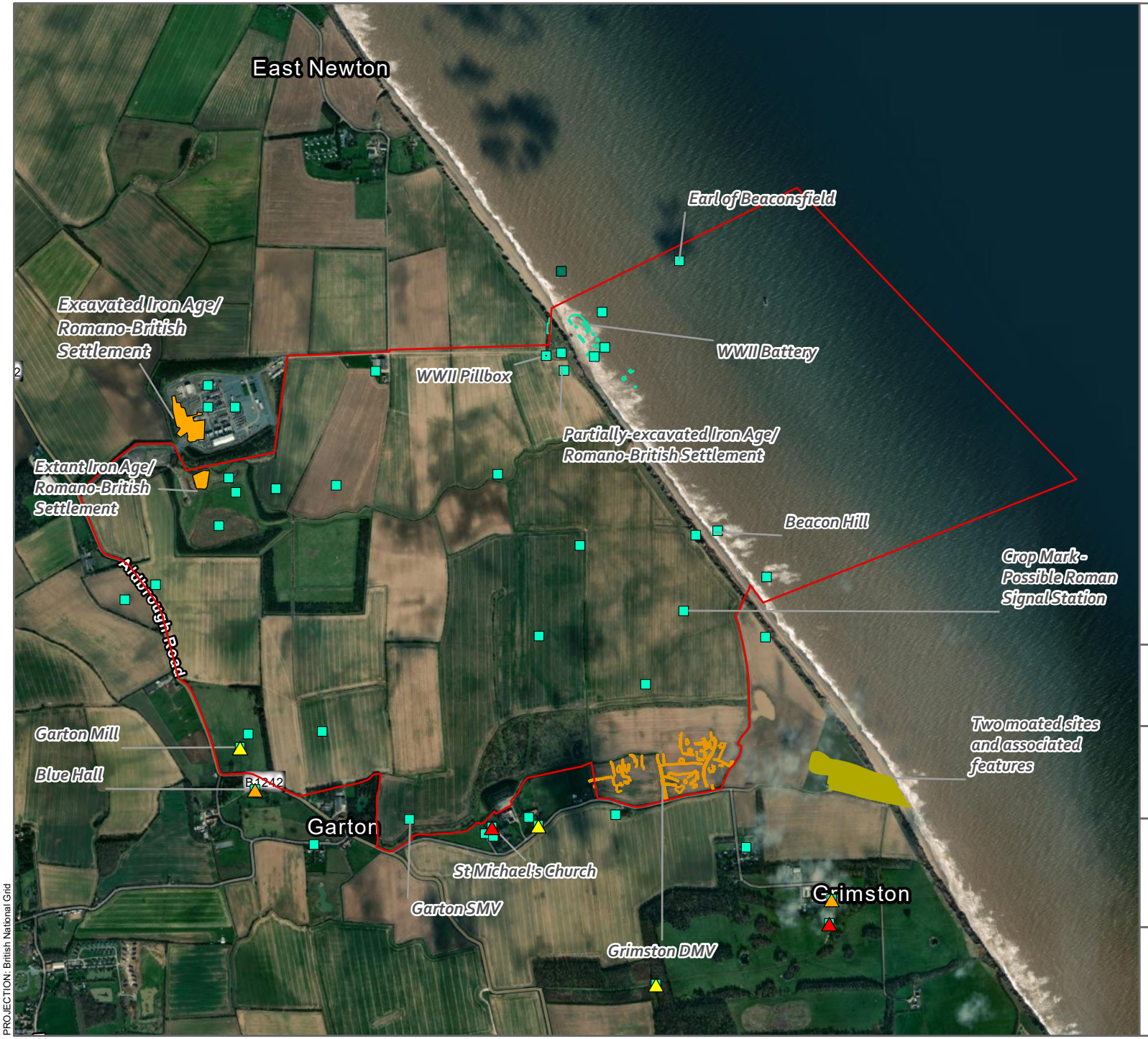
[71] Jacobs (2012) Archaeology Desk-Based Survey. Aldbrough Gas Storage Project – Phase III Environmental Statement.

[72] In the westernmost field within the Hydrogen Storage Facility Scoping Boundary.

[73] According the HER held by Humber Archaeology Partnership, “*Ringbrough Battery was first opened in 1941 and was intended to perform a dual role. Its primary function was to be as a counter-bombardment battery with a secondary role as a close defence battery. The battery comprised three 6" Mk24 guns on Mk 5 Mountings, three battery observation posts (BOP) to control firing, coast artillery searchlight emplacements (CASL) and pillboxes*.”
(https://www.hull.gov.uk/environment/environment/humber-historic-environment-record)

minefields[74]. Only part of the military installation remains on the cliff top today but many of its components still survive on the beach below (Figure 6.5).

[74] There are numerous former minefields in the area, one of which is located to the north of AGS and one immediately to the east of the current Scoping Boundary, to the north-west of Moat Farm, others have been lost to erosion (Humber Field Archaeology (2008) Rapid Coastal Zone Assessment Yorkshire And Lincolnshire: Bempton to Donna Nook. English Heritage Project 3729).



Scoping Boundary

Designated Assets

Grade

- I
- II*
- II

Scheduled Monument

Non Designated Assets

- Deserted Medieval Villages and Settlements
- Non Designated Point
- Earthwork
- Non Designated Linear
- Non Designated Area

0 250 500 750 1,000

Meters

N

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Figure 6.5
Proposed Development Cultural Heritage Context

ERM

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PROJECTION: British National Grid

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Designated assets within the Scoping Boundary

6.9.3.8 One Grade II Listed Building, Garton Mill, is located within the Scoping Boundary. It is on the western side surviving today as the brick parapet of a windmill located in an agricultural field and is clearly visible from the adjacent road, the B1242 **(**Figure 6.6**).** There are no designated registered parks and gardens, conservation areas, scheduled monuments, protected wrecks, world heritage sites or historic battlefields within the Scoping Boundary.

Figure 6.6: Garton Mill

Designated assets within 2 km

6.9.3.9 Within 2 km of the Scoping Boundary there are the following designations.

- Two Grade I listed buildings, two Grade II* listed buildings and four Grade II listed buildings. The closest is the Grade II* Blue Hall, approximately 50 m to the south.
- One scheduled monument, a former medieval manor house and grounds, is located approximately 270 m to the east. It survives today as two square moats, the largest of which is thought to have enclosed a high-status medieval manor house (Historic England). Other earthworks including fishponds also survive in the area.
- The Aldbrough and Hilston conservation areas are located on the edge of the 2 km search area.

6.9.3.10 An additional nine conservation areas are located within 7.5 km of the Hydrogen Storage Facility, whilst the Burton Constable Registered Park and Garden is situated 5.9 km to the west.

Previous Archaeological Investigations within and on the edge of the Scoping Boundary

6.9.3.11 Previous surveys undertaken as part of the planning process ahead of construction for AGS and the AGS Extension [75,76,77,78], 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[79]. This site was located mainly under the existing AGS facility, however a 2006 geophysical survey of the broader area established that it likely extends to the south[80], inside the current Scoping Boundary on the north-east edge of the proposed CPA (**Section 2.4.2** and Figure 6.7). An archaeological evaluation undertaken here in late 2007/early 2008 subsequently identified ring ditches and postholes associated with Late Iron Age pottery, confirming that the settlement did indeed extend this far south[81].

6.9.3.12 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 area and extending to the south and west, that were interpreted as part of an Iron Age field system associated with the settlement site[82]. Following consultation with heritage advisors, a decision was made to preserve the settlement part of the site *in situ*. A watching brief and soil stripping exercise, was then undertaken across the remainder of the proposed CPA location [83,84,85,86].

6.9.3.13 A second Romano-British settlement, immediately south of the former location of Ringbrough Farm, was identified during groundworks ahead of cliff stabilisation (Figure 6.5). 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[87] 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.

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

[76] WYAS Archaeological Service (2006). Aldbrough South Proposed Gas Storage Facility East Yorkshire. HHER

[77] Humber Archaeology (2006). Archaeological Excavations at the Aldbrough Gas Storage Facility Aldbrough East Riding of Yorkshire. Humber Archaeology Report No. 198.

[78] Jacobs (2012). Archaeology Desk-Based Survey. Aldbrough Gas Storage Project – Phase III Environmental Statement.

[79] Humber Archaeology (2006). Archaeological Excavations at the Aldbrough Gas Storage Facility Aldbrough East Riding of Yorkshire. Humber Archaeology Report No. 198.

[80] Geophysical survey also showed that the settlement likely extended to the west of AGS. A trial trench evaluation ahead of the Sproately 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).

[81] AOC (2008). Aldbrough Gas Storage Facility Phase II: Archaeological Trial Trenching.

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

[83] AOC (2008). Aldbrough Gas Storage Facility Phase II: Archaeological Trial Trenching.

[84] The evaluation by AOC Archaeology (2008), consisted of 70 trenches in total and was undertaken in partial fulfilment of conditions attached to a previous Phase 2 planning application (DC/06/09372/STPLFE/STRAT).

[85] Jacobs (2008). Letter from Jacobs Ltd dated 15th July 2008, accompanying submission of evaluation reports to Humber Archaeological Partnership.

[86] Network Archaeology (2008). Salt End to Aldbrough Cabling Scheme: Archaeological Excavations and Watching Brief. Unpublished Report Produced for Scottish and Southern Energy PLC. Network Archaeology Report Number 539.

[87] Jacobs (2012) Archaeology Desk-Based Survey. Aldbrough Gas Storage Project – Phase III Environmental Statement.

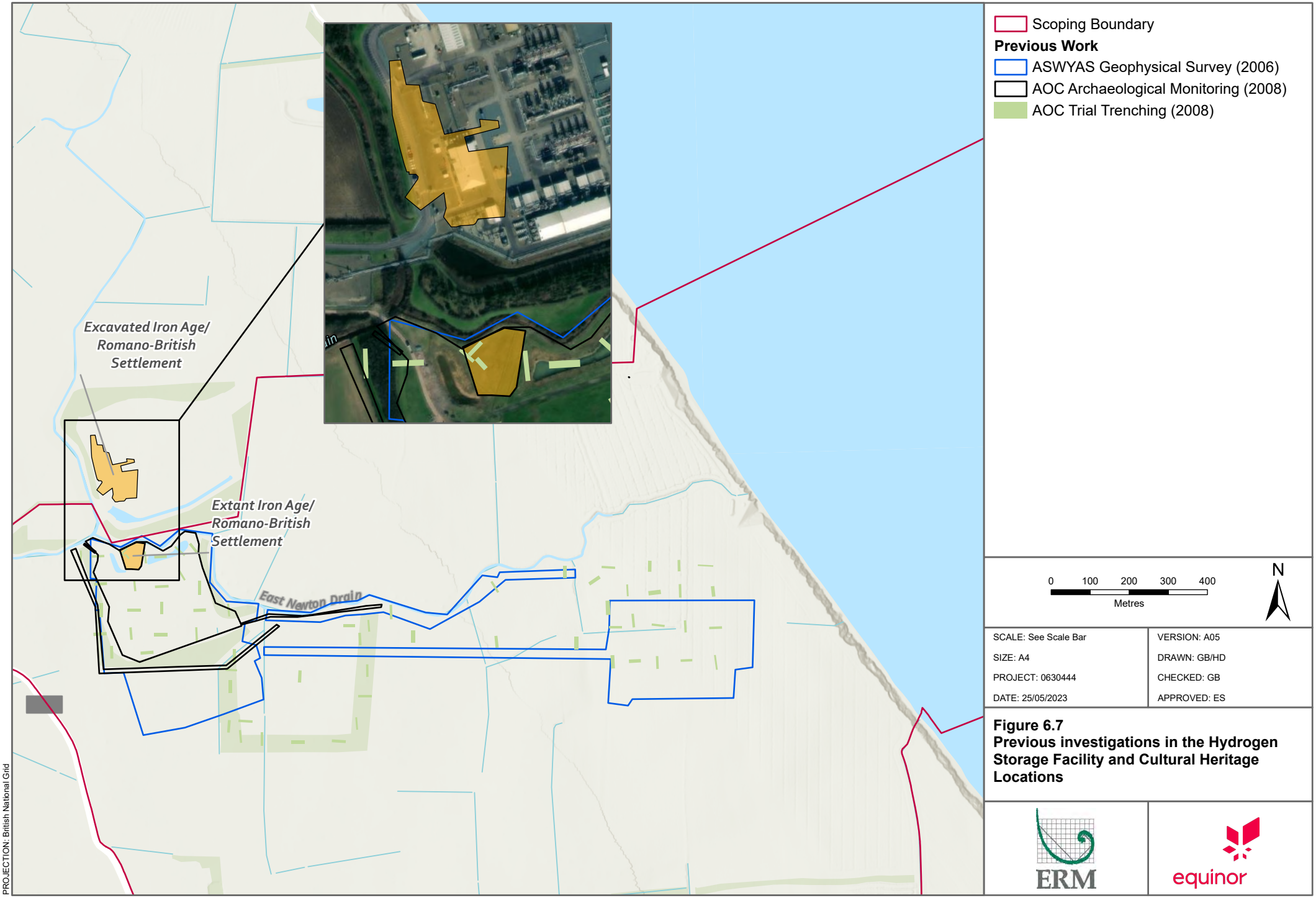

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Figure 6.7
Previous investigations in the Hydrogen Storage Facility and Cultural Heritage Locations

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PROJECTION: British National Grid

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Key Sensitivities

6.9.3.14 Aspects of the historic environment which will be most vulnerable to impacts from the Hydrogen Storage Facility are as follows:

- Archaeological features, artefacts and deposits: the Hydrogen Storage Facility 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[88]. In particular, there is known Iron Age/Romano British and WWII archaeology within the Hydrogen Storage Facility Scoping Boundary in the area of the former Ringbrough Farm, located close to the cliff edge.
- Upstanding cultural heritage assets that draw significance from their setting: there are a number of listed buildings, conservation areas and scheduled monuments within close proximity to the Hydrogen Storage Facility that are potentially vulnerable to an impact on their setting.

6.9.4 Project Basis for Scoping Assessment

6.9.4.1 The construction, operation and decommission of the Hydrogen Storage Facility 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 the CPA, the well head compound and other above ground installations. Any surface infrastructure such as access routes and car parks are also 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.

6.9.4.2 An indirect impact refers to any change in the baseline condition of a heritage asset resulting from a development beyond the Proposed Development boundaries. 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 Hydrogen Storage Facility likely to have an indirect impact on heritage assets beyond the boundary of the Proposed Development include the construction, operation and decommission of above ground installations and all associated infrastructure. It should be noted however that some earthworks were undertaken following planning approval for AGS Extension and therefore direct affects within the proposed Hydrogen Storage Facility are likely to be limited. Activities associated with the Hydrogen Storage Facility likely to have an indirect impact on heritage assets beyond the boundary of the Proposed Development include the construction and decommission of the pipeline and the construction, operation and decommission any above ground installations associated with it.

6.9.5 Mitigation

6.9.5.1 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 would be conducted, and the information gathered made available to the

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

public[89]. 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[90].

6.9.6 Likely Significant Effects to be Considered in the EIA

6.9.6.1 Table 6.21 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.

6.9.6.2 As decommissioning will be more than 30 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.

[89] Historic England (2016) Preserving Archaeological Remains Decision-taking for Sites under Development: https://historicengland.org.uk/images-books/publications/preserving-archaeological-remains/heag100a-preserving-archaeological-remains/ (Accessed 20/09/2021).

[90] Historic England (revised 2017) Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets: https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/heag180-gpa3-setting-heritage-assets/ (Accessed 20/09/2021)

Table 6.21: Likely Effects – Historic Environment

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Ground disturbance during construction phase 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 AGS Extension. ■ Develop written schemes of investigation for the construction phase (in consultation with ERYC's heritage officer) to record and report assets that cannot be avoided. ■ Develop procedures for construction to be implemented in the event of chance finds.	Medium to High	Low to High	Minor to Major	Scoped In	DBA, 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 AGS Extension.	Small	Medium to High	Minor at most	Scoped In	Preliminary settings assessments to identify any sites that have the potential to be affected by the Hydrogen Storage Facility, followed by a formal settings assessment including ZTV to include long-distance view impacts.

6.9.7 Effects Scoped out of the EIA

6.9.7.1 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).

6.9.7.2 Some parts of the Hydrogen Storage Facility have been subjected to comprehensive archaeological investigation as part of previous planning applications. This includes the southern area proposed for the CPA where the ground has already been stripped and topsoil and subsoil removed under archaeological supervision. This area can therefore be scoped out of further assessment.

6.9.8 Proposed Approach to the Assessment

6.9.8.1 The baseline data gathered during the previous planning application (Jacobs, 2012[91]) will require a detailed review and revision in light of any changes in site extent, site conditions, design specifications and legislative requirements. This reassessment 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 fieldwalking, followed by geophysical and trial trench investigations.

6.9.8.2 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;
- identify areas of high archaeological potential; and
- identify the gaps in the baseline data and potential risks of encountering unknown features during construction of the Hydrogen Storage Facility.

6.9.8.3 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 Geographical Information System (GIS) data packages that form the spatial framework for subsequent stages of the baseline data gathering programme. One of the key outputs of the DBA, is the production of a comprehensive gazetteer of every asset that may be affected by the Proposed Development. Each asset is assigned a unique identifying code and their location condition, extent and likely date is described. This gazetteer is then updated throughout the subsequent phases of investigation and forms the basis of the impact assessment.

6.9.8.4 The second stage of this process will be a walkover survey of the Hydrogen Storage Facility Scoping Boundary 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 Hydrogen Storage Facility will be undertaken during this walkover survey.

6.9.8.5 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 Hydrogen Storage Facility, it is likely that geoarchaeological work will concentrate on the alluvial deposits along the East Newton Drain and would optimally be

[91] Jacobs (2012). Archaeology Desk-Based Survey. Aldbrough Gas Storage Project – Phase III Environmental Statement.

programmed and considered alongside any pre-construction engineering works such as Ground Investigation boreholes. If deemed appropriate, trial trenching, which can be undertaken as an additional part of the assessment, or as a further stage of investigation, would be aimed at evaluating possible archaeological features identified through geophysical survey and assessing any 'blank' areas where geophysical survey was not feasible.

6.9.8.6 The fourth stage of baseline data gathering will involve fieldwalking and geophysical investigations, the extent of which will be informed by the results of the various strands of research in the DBA, and the walkover survey and assessment. Some geophysical survey was conducted ahead of the AGS Extension planning application (Jacobs, 2012), although any additional areas, including the location of the wellhead area will need to be surveyed.

6.9.8.7 As it is already established that the area identified for the Hydrogen Storage Facility has a high potential for buried archaeological remains, a programme of trial trenching to establish the nature, extent, character and significance of any buried archaeological deposits, is likely to be necessary as a fifth stage of baseline data gathering.

Assessment Criteria

6.9.8.8 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.

6.9.8.9 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 (see Figure 5.1).

6.9.8.10 Heritage assets will be assigned a level of heritage value in accordance with a four-point scale presented in Table 6.22. 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 6.22: Criteria to assess the value of heritage assets

Value	Criteria
High	■ WHS ■ 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

Value	Criteria
	■ 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

6.9.8.11 Magnitude is a measure of the nature of the expected impact and will be classified for direct and indirect effects (Table 6.23). For the purposes of visual assessment, proximity to the Hydrogen Storage Facility (within the zone of theoretical visibility) will be taken as one of the determining attributes.

Table 6.23: 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

6.9.8.12 Where potential scores of moderate or major significance are predicted for asset using the matrix-based approach shown in Figure 5.1, mitigation measures will be recommended.

6.9.8.13 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.

6.10 Traffic and Transport

6.10.1 Introduction

6.10.1.1 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.

6.10.2 Topic-specific Regulatory Requirements and Guidance

6.10.2.1 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):

- Department for Energy and Climate Change (DECC) (2021). Draft Overarching NPS for Energy (EN-1)[92];
- The Institute of Environmental Management and Assessment93 ("IEMA", 1993), 'Guidelines for the Environmental Assessment of Road Traffic';
- Highways England (2020). DMRB, CD 123 Geometric design of at grade priority and signal-controlled junctions (Rev 2 August 2020)[94];
- NPPF[95] 2021;
- Planning Practise Guidance on Travel Plan, Transport Assessment and Statements96 (Ministry of Housing, Communities & Local Government, 2014); and
- East Riding of Yorkshire Local Transport Plan Strategy 2021 - 2039[97].

6.10.3 Baseline Environment

Data Sources used in Scoping

6.10.3.1 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 (PRoW) Map; and
- Sustrans Website.

[92] Overarching National Policy Statement for Energy (EN-1). Available at: assets.publishing.service.gov.uk

[93] Institute of Environmental Assessment (1993) *Guidelines for the Environmental Assessment of Road Traffic.* Available at: https://www.thenbs.com/PublicationIndex/documents/details?Pub=IEA&DocID=257892

[94] Design Manual for Roads and Bridges (DMRB), CD 123 Geometric design of at grade priority and signal-controlled junctions (Rev 2 August 2020). Available at: https://www.standardsforhighways.co.uk/dmrb/search/5770900b-eadc-4adf- b4e0-a80ceb08b839

[95] National Planning Policy Framework (2021) [Online] Available at: assets.publishing.service.gov.uk

[96] https://www.gov.uk/guidance/travel-plans-transport-assessments-and-statements

[97] East Riding of Yorkshire Council - Local Transport Plan (2021-2039)

Description

6.10.3.2 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 Hydrogen Storage Facility 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 point to the north-west of the Hydrogen Storage Facility is currently used to access AGS.

6.10.3.3 As part of AGS, a designated haulage route for construction and operational traffic over 3 tonnes was approved. This approved route included the provision of a link road to prevent construction vehicle movements within the village of Aldbrough. Assuming that traffic is travelling from Hull, the approved route for HGV is along the A165, the B1238 through Bilton and Sproatley and then using the link road to access the Hydrogen Storage Facility via the B1242 (see Figure 6.8). It is anticipated that this established route would be utilised by the Proposed Development.

Settlements

Traffic Route as per AGS

*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 Hydrogen Storage Facility via the B1242.

0 1 2 3

Kilometers

N

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PROJECT: 0630444	CHECKED: BP
DATE: 30/05/2023	APPROVED: ES

Figure 6.8
AGS Designated Haulage Route

ERM

equinor

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - SE - Consultation Locations - A04

Key Sensitivities

6.10.3.4 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;
- non-motorised users of the surrounding highway network, PRoW and non designated public routes including pedestrians, cyclists, and equestrians (and vulnerable groups); and
- residents within the settlements of Bilton, Sproatley, Flinton and Aldbrough.

6.10.4 Project Basis for Scoping Assessment

6.10.4.1 The traffic and transport scoping assessment is based on the following:

- the construction activities outlined in **Section 2.4.3.5** which will generate traffic movements on the highway network (including the Strategic Road Network), including the transportation of abnormal loads associated with the delivery of various components for the Hydrogen Storage Facility;
- drilling-related traffic which will be generated according to the drilling schedule rather than that of general construction;
- generation of traffic during operation affecting the highway network (including the Strategic Road Network). Workforce numbers are to be confirmed as part of the PEIR; and
- generation of traffic during decommissioning affecting the highway network (including the Strategic Road Network).

6.10.5 Mitigation

6.10.5.1 The Traffic and Transport ES chapter (and corresponding PEIR chapter) 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; and
- an Operational Traffic Management Plan (OTMP), if one is required, to mitigate the impact of the operational phase and associated traffic, otherwise known as an Operational Worker Travel Plan.

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

6.10.6 Likely Significant Effects to be Considered in the EIA

6.10.6.1 Table 6.24 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.

6.10.6.2 As decommissioning will be more than 30 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.

Table 6.24: Likely Effects – Traffic and Transport

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Road Safety – Construction and drilling phase	Good practice measures outlined within the CTMP	Medium	High	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 and drilling phase	Good practice measures outlined within the CTMP	Medium	High	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	Large	High	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 – Construction and drilling phase	Good practice measures outlined within the CTMP	Large	High	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 and drilling phase	Good practice measures outlined within the CTMP	Medium	High	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.

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Abnormal Indivisible Loads – Construction and drilling phase	Good practice measures outlined within the Abnormal Load Route Assessment	Large	High	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. Swept path analysis of key junctions, bends and other constraints on the route.	Details of the various component for the storage facilities; Mapping for the swept path analysis.
Hazardous Loads - Construction and drilling phase	N/A	Small	High	Not likely significant	Scoped Out	N/A
Air Quality – Construction and drilling phase	N/A	Small	High	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 6.5**).	N/A
Noise – Construction and drilling phase	Practicable noise control measures, following appropriate guidance (See **Section 6.6.5**)	Small	High	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 6.6**).	N/A
Impact from traffic generation – Operational phase (Hydrogen Storage Facility)	Good practice measures outlined within the OTMP	Negligible	High	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	New traffic flow data for roads and junctions within the study area

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
					negligible and will have no significant effects on sensitive receptors, and a proportional assessment can be undertaken.	
Decommissioning	N/A	Medium	High (to be re-assessed when decommission is scheduled)	Likely significant	Scoped Out. It is not possible to accurately forecast baseline traffic flow levels 30 years into the future. For this reason, further work would be undertaken at the time of decommissioning to determine if significant transport effects might be experienced.	N/A

6.10.7 Effects Scoped out of the EIA

6.10.7.1 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).

Noise

6.10.7.2 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 Hydrogen Storage Facility 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 6.6**). Therefore, it is proposed that assessment of noise and vibration, as a result of road traffic, is scoped out of the traffic and transport assessment.

Air Quality

6.10.7.3 Current guidance[98] 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.

6.10.7.4 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, it is understood that the Hydrogen Storage Facility is not located in an AQMA, and due to the temporary nature of the increase in vehicles using the proposed access route, 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 6.5**). It is proposed that assessment of operational traffic impacts on air quality is scoped out of the assessment.

Hazardous Loads

6.10.7.5 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.

Decommissioning

6.10.7.6 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 Hydrogen Storage Facility will be operational for 30 years. It is not possible to accurately forecast baseline

[98] Design Manual for Road and Bridges – LA 105 Air Quality [Online] Available at: https://www.standardsforhighways.co.uk/prod/attachments/10191621-07df-44a3-892e-c1d5c7a28d90?inline=true

traffic flow levels 30 years into the future. For this reason, further work would be undertaken at the time of decommissioning to determine if significant transport effects might be experienced.

6.10.8 Proposed Approach to the Assessment

Baseline

6.10.8.1 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 Hydrogen Storage Facility.

6.10.8.2 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.

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

Specific Methodologies

6.10.8.4 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.

6.10.8.5 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.

6.10.8.6 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.

6.10.8.7 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.

6.10.8.8 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.

6.10.8.9 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.

Assessment Criteria

6.10.8.10 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 6.25 details the framework for determining the sensitivity of receptors.

Table 6.25: 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, local 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.

Magnitude of Change

6.10.8.11 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.

6.10.8.12 The criteria for assessing the magnitude of change on those receptors described above are presented in Table 6.26.

Table 6.26: 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%
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		

Significance of Effect

6.10.8.13 Table 6.27 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 6.27

Table 6.27: 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

6.10.8.14 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'.

Abnormal Load Assessment

6.10.8.15 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 in order to make the route viable.

7. ENVIRONMENTAL TOPICS AND POTENTIAL EFFECTS: MARINE

7.1 Introduction

7.1.1.1 This section of the Scoping Report considers the potential effects from construction, operation and maintenance, and decommissioning activities of the Marine Infrastructure. The following topics are to be considered in this section of the scoping report: Physical Environment and Water Quality, Benthic and Intertidal Ecology, Fish and Shellfish Ecology, Marine Mammals, Marine Archaeology, Commercial Fisheries, Seascape and Visual Resources, Infrastructure and Other Users and Shipping and Navigation. Subsea noise is considered as part of Marine Mammals, and Aviation and Radar was not considered as part of this Scoping Report due to the scale of the Proposed Development.

7.2 Study Areas

7.2.1.1 The marine topic assessment study areas are clarified in Table 7.1.

Table 7.1: Marine Study Areas

Topic	Study Area
Physical Environment and Water Quality	The Proposed Development area in the context of the wider Holderness coast
Benthic and Intertidal Ecology	The Proposed Development area in the context of the wider Holderness coast
Fish and Shellfish Ecology	The Proposed Development area in the context of the wider Holderness coast
Marine Mammals	The Proposed Development area in the context of the wider Holderness coast
Marine Archaeology	Within the Scoping Boundary (designated and non-designated sites) and 2 km from the Scoping Boundary (designated sites and shipwrecks). Previous investigations in the immediate vicinity of the Proposed Development were also assessed.
Commercial Fisheries	The Proposed Development area in the context of the wider Holderness coast
Seascape and Visual Resources	All seascape and visual receptors in 25 km radius seawards from the Proposed Development area
Infrastructure and Other Users	All infrastructure and other marine user receptors in 25 km radius seawards from the Proposed Development area
Shipping and Navigation	The Proposed Development area up to mean high water

7.3 Physical Environment and Water Quality

7.3.1 Introduction

7.3.1.1 This section of the Scoping Report identifies the aspects of the marine and coastal environment (e.g. geology, physical oceanography, sediment transport processes, coastal geomorphology and water quality) that the Proposed Development could impact on. Impacts on these aspects of the marine environment, were they to be of sufficient magnitude, could lead to potentially significant effects on biological and human receptors that are sensitive to certain physical and chemical changes. The purpose of assessing

impacts on these aspects is to provide the basis (i.e. impact magnitudes) for assessing likely significant effects on biological and human receptors (including built and cultural assets) elsewhere in the EIA, and also supporting the MCZ assessment and HRA.

7.3.2 Topic Specific Regulatory Requirements and Guidance

NPSs

7.3.2.1 The planning policy on NSIPs, specifically in relation to coastal processes, is contained in the Overarching NPS for Energy (EN-1; DECC, 2011a).

7.3.2.2 NPS EN-1 highlights several factors relating to the determination of an application and in relation to mitigation specifically.

- "The ES should include an assessment of the effects on the coast. In particular, applicants should assess:
    - The impact of the proposed project on coastal processes and geomorphology, including by taking account of potential impacts from climate change. If the development will have an impact on coastal processes the applicant must demonstrate how the impacts will be managed to minimise adverse impacts on other parts of the coast;
    - The implications of the proposed project on strategies for managing the coast as set out in Shoreline Management Plans (SMPs), any relevant Marine Plans and capital programmes for maintaining flood and coastal defences;
    - The effects of the proposed project on marine ecology, biodiversity and protected sites;
    - The effects of the proposed project on maintaining coastal recreation sites and features; and
    - The vulnerability of the proposed development to coastal change, taking account of climate change, during the project's operational life and any decommissioning period" (Paragraph 5.5.7 of NPS EN-1).
- "*For any projects involving dredging or disposal into the sea, the applicant should consult the Marine Management Organisation (MMO) at an early stage*" (Paragraph 5.5.8 of NPS EN-1).
- "*The applicant should be particularly careful to identify any effects of physical changes on the integrity and special features of Marine Conservation Zones (MCZs), candidate marine Special Areas of Conservation (cSACs), coastal SACs and candidate coastal SACs, coastal Special Protection Areas (SPAs) and potential Sites of Community Importance (SCIs) and Sites of Special Scientific Interest (SSSI)*" (Paragraph 5.5.9 of NPS EN-1).
- *"The Secretary of State should not normally consent new development in areas of dynamic shorelines where the proposal could inhibit sediment flow or have an adverse impact on coastal processes at other locations. Impacts on coastal processes must be managed to minimise adverse impacts on other parts of the coast. Where such proposals are brought forward consent should only be granted where the Secretary of State is satisfied that the benefits (including need) of the development outweigh the adverse impacts*" (Paragraph 5.5.11 of NPS EN-1).
- *"Applicants should propose appropriate mitigation measures to address adverse physical changes to the coast, in consultation with the MMO, the EA, local planning authorities (LPA)s, other statutory consultees, Coastal Partnerships and other*

coastal groups, as it considers appropriate. Where this is not the case the Infrastructure Planning Commission (IPC) should consider what appropriate mitigation requirements might be attached to any grant of development consent" (Paragraph 5.5.17 of NPS EN-1).

Marine Strategy Framework Directive

7.3.2.3 The Marine Strategy Framework Directive (MSFD) high-level descriptors of Good Environmental Status relevant to marine processes include:

- *"Descriptor 6: Sea floor integrity: Seafloor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.*" and
- *"Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems."*

Marine Plans

7.3.2.4 The East Inshore and East Offshore Marine Plans – ECO1 states: *"Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be addressed in decision-making and plan implementation."*

7.3.2.5 The East Inshore and East Offshore Marine Plans – MPA1 states: *"Any impacts on the overall marine protected area (MPA) network must be taken account of in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network."*

UK Marine Policy Statement

7.3.2.6 The UK Marine Policy Statement states that *"Coastal change and coastal flooding are likely to be exacerbated by climate change, with implications for activities and development on the coast. These risks are a major consideration in ensuring that proposed new developments are resilient to climate change over their lifetime. Account should be taken of the impacts of climate change throughout the operational life of a development including any de-commissioning period."* This is as well as *"Interruption or changes to the supply of sediment due to infrastructure has the potential to affect physical habitats along the coast or in estuaries."*

7.3.3 Baseline Environment

Data Sources Used for Scoping

7.3.3.1 A desk-based review of literature and existing data sources was undertaken to support this Scoping Report. The data sources listed and summarised below cover the Proposed Development offshore area.

- **EMDODnet**: The European Marine Observation and Data Network (EMODnet) was used for thematic mapping of bathymetry, seabed substrate and geology to provide an overview of seabed conditions.
- **UKHO**: United Kingdom Hydrographic Office (UKHO) was used for digital hydrographic surveys, complements EMODnet bathymetry (mainly derived from same datasets) and enables derivation of greater spatial detail.
- **Southern North Sea Sediment Transport Study (HR Wallingford, CEFAS/UEA, Posford Haskoning, and Brian D'Olier, 2002)**: an in-depth review of the sediment transport regime across the Southern North Sea, including net transport directions deduced from bedform indicators.

- **UK Offshore Energy Strategic Environmental Assessment. Phase 3 (OESEA3) (DECC, 2016)**: a regional sea description with summaries of geology, processes and sedimentology.
- **Sand banks, sand transport and offshore wind farms (Kenyon & Cooper, 2005):** complements the Southern North Sediment Transport Study and includes UK-wide and regional perspective of net bedload sediment pathways.
- **Suspended sediment mapping (CEFAS, 2016)**: synoptic description of seasonal (monthly) variation in (surface) suspended particulate matter derived from long-term satellite observations.

Description

Seabed and Sediments

7.3.3.2 The offshore Proposed Development area is predominantly circalittoral coarse sediment with areas of circalittoral fine sand, circalittoral muddy sand, and circalittoral mixed sediments (EMODnet, 2022). The offshore pipeline will be located within the Holderness Inshore MCZ which extends circa 5.5 km (3 nautical miles) from the shore and is designated for seabed habitats. Water depths vary from 0 to 12m msl depth within the Proposed Development area.

7.3.3.3 The coastal environment of the Holderness coastal waters is naturally turbid due to erosion of the cliffs and of the seabed resulting in large amounts of sediment eroding into the sea and then mobilised in a net southward direction by sediment transport processes. According to HR Wallingford (HR Wallingford, 2002) Southern North Sea sediment transport study, phase 2: sediment transport report EX 4526) the potential rate of longshore drift in the nearshore area between Hornsea and Easington is 200,000 to 350,000 m^3yr^{-1}.

Water Column

7.3.3.4 The Proposed Development area experiences a tidal exchange of water with a flood tide that flows in a general south-easterly direction down the North Sea and an ebb tide that drains away to the north-west. Generally, in the area of the North Sea containing the Proposed Development area, the mean spring maximum rate is around 0.61 m/s and the corresponding mean neap rate 0.29 m/s.

7.3.3.5 Wave observations during Hornsea Project 4 surveys, approximately 75 km north-east of the Proposed Development area, suggested the most frequent wave direction is from the north-west, with the largest wave heights also occurring from this direction. Seasonal variation indicated that typical summer wave heights were around 1.53 m increasing to an average winter wave height of 2.29 m. The maximum observed wave height (Hs) during the survey was 4.48 m (Hornsea, 2018).

7.3.3.6 Regional scale interpretations of bedload sediment transport suggest a north-westerly (net) transport pathway for the offshore area which is seaward of a bedload parting zone (Kenyon & Cooper, 2005).

7.3.3.7 The southern North Sea is typically described as a well-mixed water body. Near-bed water temperatures recorded at Site L1 are generally around 9.5°C (DECC, 2016). Well-mixed conditions are mainly due to shallower depths and the ability of winds and tides to stir water sufficiently without the onset of any stratification (DECC, 2016).

Existing Infrastructure

7.3.3.8 Along the coastline throughout East Riding of Yorkshire there is a wide range of infrastructure including water and sewerage infrastructure, outfalls, Royal National Lifeboat

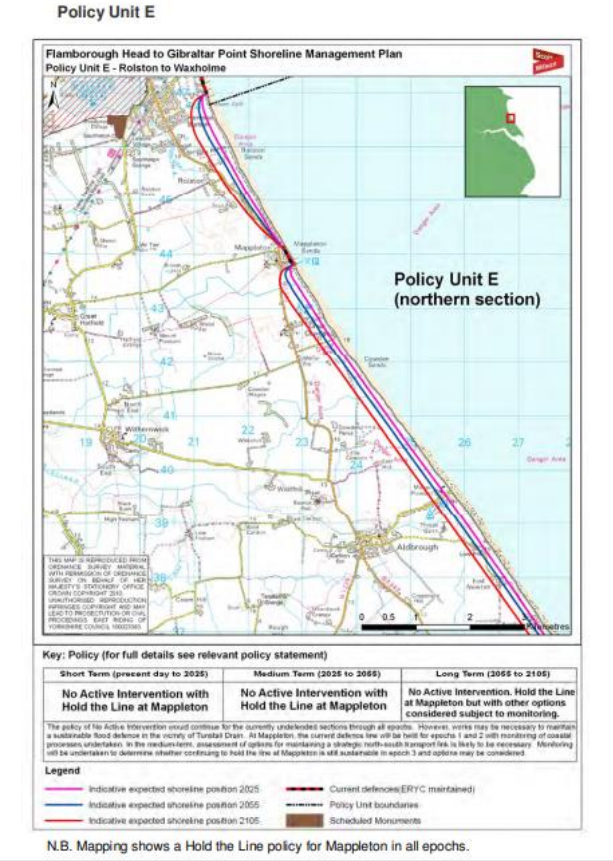
Institution (RNLI) stations, coastguard stations, coastal access points, wind farm infrastructure, piers, slipways, reservoirs, and visitor centres. At the Proposed Development area itself the marine infrastructure used for the construction and operation of AGS is present.

Coastal Change

7.3.3.9 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. The impact of waves onto the toe of the cliff causes the formation of a wave cut notch. Subsequent removal of material from the base by wave action causes the cliff face to steepen until it eventually reaches a critical angle, at which point it collapses. A collapse usually takes the form of a landslip. Some secondary cliff falls are caused by the action of rain and surface water run-off percolating into the cliffs.

7.3.3.10 The Shoreline Management Plan 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.

Figure 7.1: Extract from Shoreline Management Plan showing the policy unit for the Aldbrough stretch of coastline



N.B. Mapping shows a Hold the Line policy for Mappleton in all epochs.

7.3.3.11 The marine environment in the study area has been designated as a MCZ. Holderness Inshore MCZ covers an area of 309 km^2 and extends approximately 5.5 km (3 nautical miles) offshore from the Holderness Coast. The MCZ is designated for the following

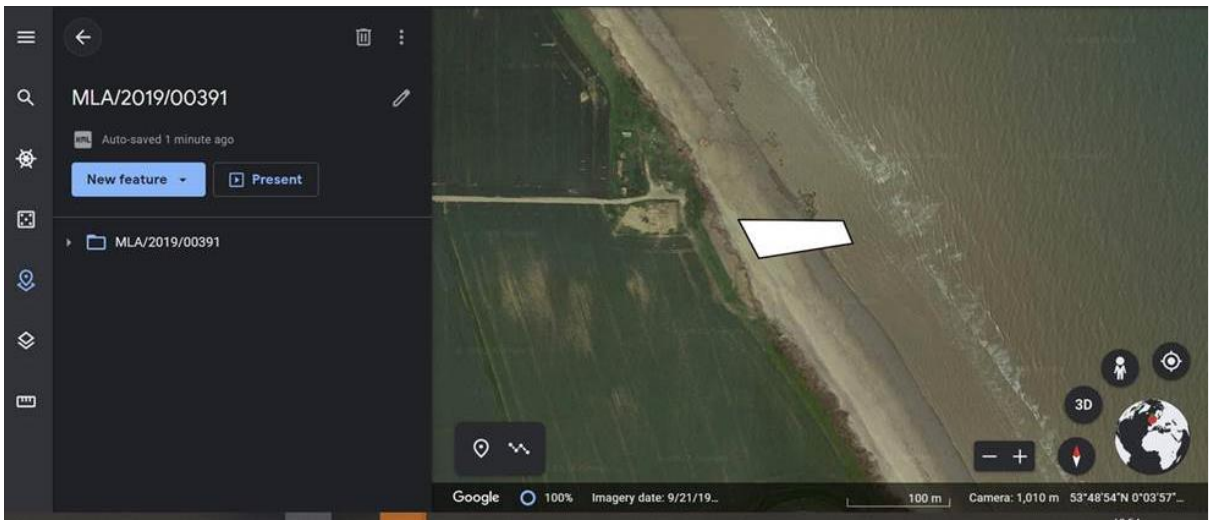
features for all of which the general management approach is to 'Maintain in favourable condition':

- intertidal sand and muddy sand;
- moderate energy circalittoral rock;
- high energy circalittoral rock;
- subtidal coarse sediment;
- subtidal mixed sediments;
- subtidal sand;
- subtidal mud; and
- Spurn Head (subtidal) (geological feature).

7.3.3.12 The mosaic of seabed habitats within the MCZ supports a diverse range of benthic species, especially encrusting fauna, together with various fish species, as well as commercially significant shellfish such as European lobster (*Homarus gammarus*).

7.3.3.13 Pipework is present in the area associated with AGS. The pipework is composed of a plastic material, redundant and not operational. The plastic pipework, which was installed for the discharging of brine to the sea during construction of the gas caverns, is now exposed where it crosses the beach. A marine licence application for its removal (refused) indicates the pipework's partial location in Figure 7.2 below.

Figure 7.2: Approximate location of former brine discharge pipework



Source: Google Earth, MMO Public Register MLA/2019/0391

7.3.3.14 The Coastal Explorer map on the ERYC's website Coastal Explorer[OBJ] indicates three 'lost villages' namely Old Aldbrough, Ringborough and Monkwell.

7.3.3.15 These are villages lost from coastal erosion over time and over the last 1,000 years, the Holderness coast has retreated by around 2 km, causing the loss of 26 villages listed in the Domesday survey of 1086 (see **Section 6.9**).

Figure 7.3: Approximate location of 'lost villages' caused by coastal erosion

Key Sensitivities

7.3.3.16 The main sensitive aspects of the physical environment are the following:

- seabed substrate (in turn providing habitat for marine fauna and interest features of the MCZ);
- prevailing physical processes of sediment transport;
- coastal change proceeding at a natural rate (taking into consideration the effects of future climate change); and
- factors that influence the dispersion of the brine discharge produced during leaching of the caverns.

7.3.4 Project Basis for Scoping Assessment

7.3.4.1 Scoping is based on the maximum design scenario of complete replacement of the diffuser and pipelines, together with temporary activities to facilitate this such as provision of a cofferdam at the foreshore during construction (see **Section 2.4.3)**. The construction and operational presence of the marine infrastructure has the potential to temporarily, physically alter the environment (e.g. wave regime, sediment transport). Physical changes to the environment could have the potential for secondary effects on coastal amenity and conservation features.

7.3.4.2 During construction, there will be a brine discharge with the potential to affect water quality and have secondary effects on marine fauna.

7.3.4.3 The maximum design scenario for construction related issues that involve the largest volumes of disturbed sediment from seabed preparation activities, includes:

- installation of new pipelines and diffuser; and
- construction of temporary cofferdam on the foreshore.

7.3.5 Mitigation

7.3.5.1 As part of the Proposed Development design process, a number of mitigation measures have been proposed to reduce the potential for impacts on marine geology, oceanography and physical processes. These mitigation measures may change through the EIA process as the technical project parameters are refined and consultation input is provided.

- Sensitive features within the Holderness Inshore MCZ will be avoided where possible (in consultation with statutory nature advisors).
- A scour protection layer (typically rock) may be needed on the seabed around the diffuser and intake and would be profiled to minimise the interruption of sediment transport.
- The design of facilities, especially pipeline burial depth and set back distance for facilities from the cliff edge will take account of future coastal change.
- The effects scoped into the EIA will be related to changes to suspended sediment. The construction and decommissioning activities such as trench cutting, drilling, pipelaying and seabed levelling will lead to increased levels of suspended sediment. The activities will be sited to avoid sensitive features of the Holderness Inshore and Offshore MCZ. The magnitude of wider impacts is predicted to be negligible as the size and nature of the sediment are such that particles will fall out of suspension relatively quickly, minimising the area of impact.

7.3.6 Effects Scoped Out of EIA

7.3.6.1 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).

Changes to Sediment Transport affecting Morphological Features of the MCZ

7.3.6.2 Given the anticipated localised nature of the changes to tidal currents and waves for the Proposed Development, it is anticipated that changes in the sediment transport regime will be small and localised during both construction and operation. The assessment will therefore be based on a semi-quantitative approach using the published evidence base to establish the magnitude of such impacts; sediment transport modelling is not considered necessary.

Changes to Wave Regime and Coastal Morphology

7.3.6.3 The scale of the Proposed Development is too small to have an impact on coastal morphology through changes to waves regimes.

7.3.7 Proposed Approach to the Assessment

7.3.7.1 An evidence-based approach is proposed for the impact assessment of physical process issues that also remains proportionate to the anticipated magnitude of change and potential for significant effects and to demonstrate that the possible relevance of issues has been considered. Assessments are proposed which will refer to previous modelling of wave related effects and sediment transport studies. No mathematical modelling is proposed.

7.3.7.2 Geophysical and benthic marine surveys will be undertaken to establish the sediment make-up and benthic features present within the Proposed Development area.

7.3.7.3 Assessment will be undertaken based on spoil volumes, particle size, water depths and current speeds. The assessment will establish the magnitude of physical and chemical

changes so that other EIA topics (e.g. benthic ecology, fish and shellfish) can assess whether these changes will lead to a significant effect.

7.3.7.4 As decommissioning will be more than 30 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.

7.4 Benthic and Intertidal Ecology

7.4.1 Introduction

7.4.1.1 This section of the Scoping Report identifies the benthic and intertidal ecology receptors of relevance to the Proposed Development and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore and shoreline components (i.e. temporary cofferdam) of the Proposed Development on benthic habitats and species.

7.4.2 Topic-specific Regulatory Requirements and Guidance

7.4.2.1 The topic-specific regulatory requirements and guidance is the same as those used for the assessment in **Section 7.3**.

7.4.3 Baseline Environment

Data Sources used for Scoping

7.4.3.1 Several benthic and intertidal ecology datasets have been reviewed and collated to inform this Scoping Report. Table 7.2 summarises the key data sources of benthic and intertidal ecology data used. Data have also been collected from a desk-based review of publicly available information.

Table 7.2: Summary of Key Benthic and Intertidal Datasets

Reference	Summary	Proposed Development / Study Location
Orsted, 2021	Specific - Assessment of benthic and intertidal ecology across the Hornsea Four Offshore wind farm array area and export cable route.	Situated approximately 75 km northeast of the scoping boundary between Flamborough Head and Hornsea.
Department for Business, Energy & Industrial Strategy, 2022 – Section A1a.2 – Benthos	General – UK Offshore Energy Strategic Environmental Assessments (SEA) on Gov.co.uk include information on benthic ecology of the Holderness coast (as well as Birds, Marine Mammals, Fish & Shellfish, Geology, Landscape/Seascape and more) – useful and relevant reports to this project	General to the southern North Sea.
International Council for Exploration of the Sea (IECS), Proctor 2004	Specific – marine environmental baseline surveys along the nearshore coastal margins of the Holderness coastline. Assessment submitted for discharge consent for Aldbrough. See Figure 7.4 **and** Figure 7.5 below for locations of sample locations in relation to existing infrastructure	Located in the scoping boundary.

Reference	Summary	Proposed Development / Study Location
IECS, Perez-Dominguez et al, 2012	Specific - benthic invertebrate assessment of the marine environment at Aldbrough as part of monitoring works in relation to brine discharge. See Figure 7.4 **and** Figure 7.5 below for locations of sample locations in relation to existing infrastructure	Nearest and most recent available samples and data on benthic ecology at the scoping boundary.
DEFRA, JNCC and Natural England, 2016	General – Holderness inshore and offshore MCZ	Inshore MCZ stretching from Spurn Head in the south along the Holderness Coast and ending past Hornsea (covering the inshore region of Aldbrough).

Figure 7.4: Subtidal benthic stations (Proctor, 2004)

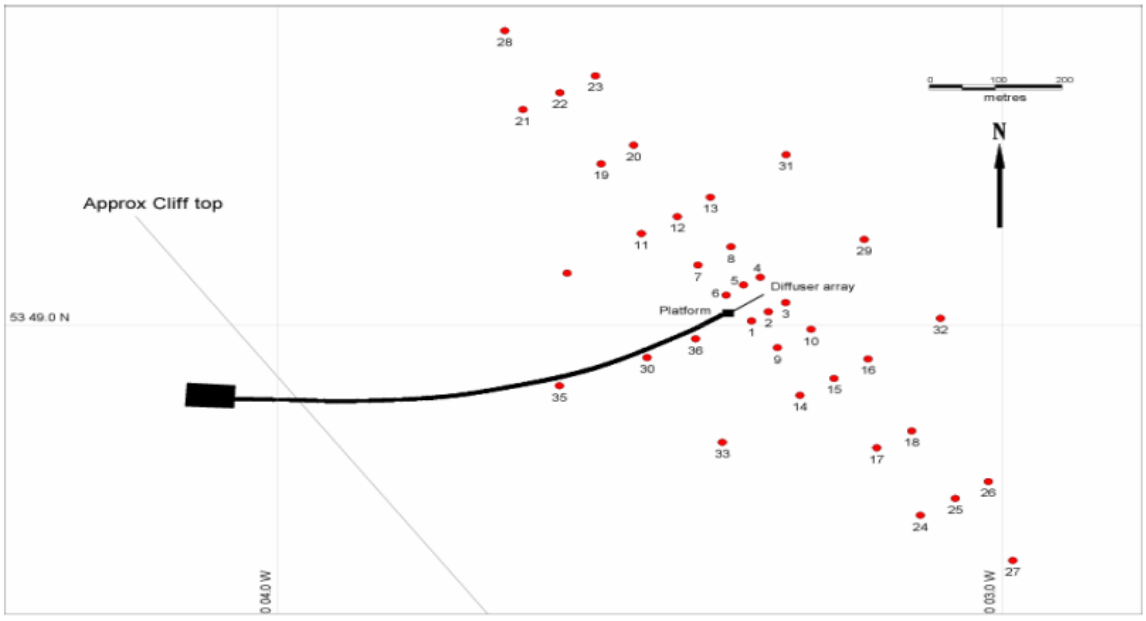
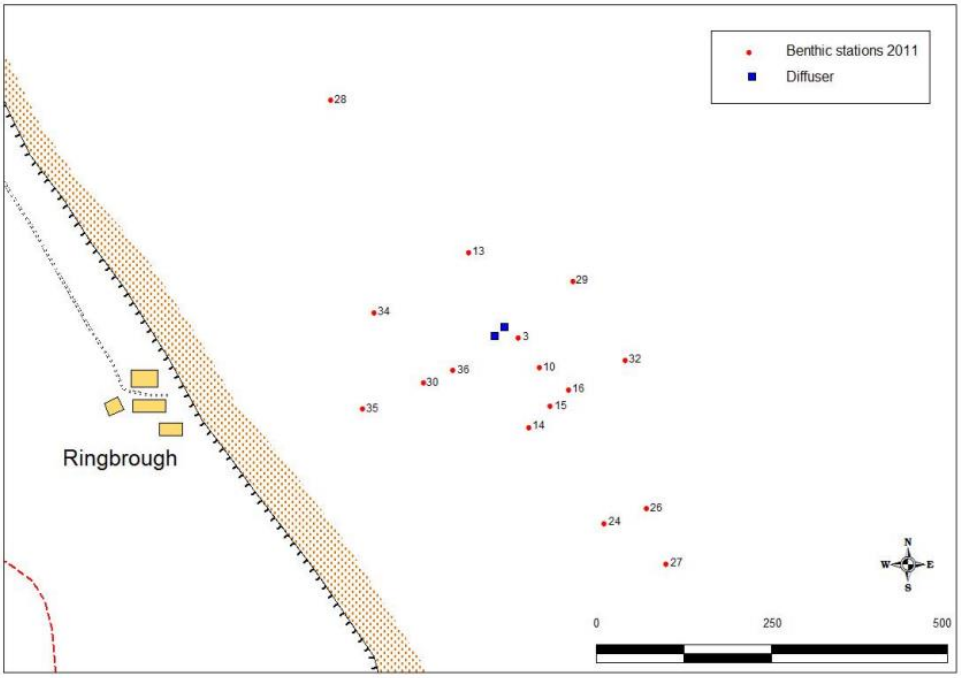


Figure 7.5: Position of the benthic sampling sites where valid grab samples were obtained in 2011 (Perez-Dominguez et al, 2012)



Description

7.4.3.2 Benthic and intertidal fauna abundance and diversity along the Holderness coast, south of Flamborough Head, is generally high. It consists mainly of: benthic habitats composed of sandy gravel closer to shore; sand with patches of gravel, muddy sand, occasional scoured areas of boulder further offshore; and medium/fine sands along the intertidal fringe.

7.4.3.3 The Scoping Boundary is located within the Holderness Inshore MCZ which extends from Spurn Head to Hornsea. The MCZ was designated in 2016 to protect the following features:

- intertidal sand and muddy sand;
- moderate energy circalittoral rock;
- high energy circalittoral rock;
- subtidal coarse sediment;
- subtidal mixed sediments;
- subtidal sand;
- subtidal mud; and
- Spurn Head (subtidal).

7.4.3.4 The protected habitats of the inshore MCZ support a diverse range of organisms including red algae, anemones and sponges, encrusting fauna such as cup corals, together with starfish, brittlestars and sea urchins. In the intertidal region, sand and muddy sand are uncovered at low tide supporting worms, and muddier sands support bivalves, including the common cockle (*Cerastoderma edule*), and sea snails such as the laver spire shell (*Peringia ulvae*).

7.4.3.5 Within the Scoping Boundary, diversity of benthic species present is largely dominated by mobile invertebrates and crustacean amphipods. A reef forming polychaete worm called the Ross worm (*Sabellaria spinulosa)*, included within the OSPAR list of threatened and/or declining species and habitats, has previously been identified within the Proposed Development area. However, its distribution was minimal with no evidence of extensive reef formation (Proctor, 2004). During the benthic survey reported in Proctor (2004) undertaken as part of baseline assessment of the marine environment at AGS, diversity and density of infaunal invertebrates in the intertidal region of the Scoping Boundary was found to be low, characteristic of the area's high sediment mobility. Farther offshore, diversity of benthic species was moderate.

7.4.3.6 A new offshore pipeline is proposed to be trenched and then backfilled (**Section 2.4.3**) causing physical disruption to the seabed, and an outfall pipe will discharge brine offshore (**Section 2.4.3**) which may lead to localised impacts due to increased salinity. The key receptors which may be affected by the Proposed Development include some features of the Holderness Inshore MCZ. Previous surveys conducted in 2011, as part of monitoring works within the Scoping Boundary, assessed that benthic communities did not appear significantly affected over a period of 10 years as a result of brine discharge. Therefore, similar considerations are likely to apply for the Proposed Development if the discharge characteristics and ambient conditions remain broadly the same.

7.4.3.7 The key features of the Holderness Inshore MCZ are as follows:

- Sandy sediments with low infaunal diversity and sparse epibenthic communities comprising of the biotopes:
- *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand (SS.SSa.IMuSa.FfabMag);
- *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri); and,
- *Nephtys cirrosa* and *Bathyporeia spp*. in infralittoral sand (SS.SSa.IFiSa.NcirBat).
- Coarse and mixed sediments with moderate to high infaunal diversity and scour tolerant epibenthic communities:
- *Mysella bidentata* and *Thyasira spp*. in circalittoral muddy mixed sediment (SS.SMx.CMx.MysThyMx); and
- *Mytilus edulis* beds on sublittoral sediment (SS.SBR.SMus.MytSS).
- Robust impoverished intertidal communities associated with high energy sediments:
- Barren littoral sand (LS.LSa.MoSa.BarSa);
- small areas of coarse sediment (LS.LCS).

7.4.3.8 The desktop data review provides an important and useful source of evidence in relation to the surrounding areas of seabed and the wider region. Surveys carried out at other locations along the coast up to Flamborough Head, such as the Hornsea Project Four Offshore Wind Farm, provide recent and comprehensive data on benthic ecology of the Holderness coast. However, sampling within the scoping boundary is limited and most recently took place in 2011 (IECS, 2012). Site-specific baseline characterisation surveys of the benthic and intertidal habitats will likely need to be conducted to confirm current biotope classifications and presence of sensitive or protected features within the scoping boundary.

Key Sensitivities

7.4.3.9 Sensitive features within the Scoping Boundary are likely to include the following.

- Around the existing monopile location, diffuser and the section of pipeline farther from shore, habitats characterised by gravelly mixed sediments with patchy cobble and boulder with variable epibenthic species will be most vulnerable to the effects of construction disturbance and operational discharges.
- The above substrata also support some encrusting organisms which are less tolerant to disturbance as well as providing habitat for crustaceans such as European lobster.
- Further inshore sand and gravelly sand habitats are generally more dynamic, affected by wave action and support lower abundance and diversities of benthic fauna. These habitats are less vulnerable to physical disturbance and quicker to recover to a pre-existing state under natural conditions.

7.4.4 Mitigation

7.4.4.1 In the first instance the Proposed Development will seek to maximise the use of existing marine infrastructure. Where this is not possible, the construction footprint will be minimised to the extent practicable. A backfilling strategy will be developed for the pipeline trench which considers the relative benefits of natural backfill (e.g. for areas of sand and sandy gravel) versus some form of reinstatement works in areas of coarser gravels and cobbles.

7.4.4.2 The diffuser will be designed to maximise the dispersion of the brine discharge during leaching of the caverns. Scour protection will be installed around all infrastructure that protrudes above the seabed. Scour protection will generally provide a hard substrate similar to that used by encrusting organisms.

7.4.4.3 Discharge consent conditions will be defined to impose upper limits to the brine discharge rates and concentration in order to mitigate impacts on marine organisms.

7.4.5 Likely Significant Effects to be Considered in the EIA

7.4.5.1 **Table 7.3** provides a high-level assessment of the effects on the benthic and intertidal ecology at the scoping stage of the EIA process. The assessment is based on the envelope defined in the **Chapter 2 Proposed Development Description**, embedded mitigation measures if applicable, the evidence for potential benthic and intertidal ecology effects, relevant policy, the assessment criteria provided in **Chapter 5 EIA Methodology** and the professional judgement of qualified benthic and intertidal ecologists.

7.4.5.2 Table 7.3 sets out a high-level assessment of all the potential significant effects and defines which are to be scoped into the EIA. Construction and operational effects are outlined in Table 7.3; however decommissioning effects are anticipated to be no worse than construction effects and will be accordingly assessed where necessary and to the extent it is practicable to do so at the EIA stage in the absence of a decommissioning plan. Any decommissioning works will be subject at the time to its own assessment and Marine Licence application.

Table 7.3: Likely Effects - Benthic and Intertidal Ecology

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction: sediment resuspension and smothering effects on fauna	N/A	Small	low to Medium	Minor	Scoped In	Site-specific benthic surveys
Construction: temporary habitat loss and disturbance	Routes will be micro-sited and sensitive habitats will be avoided to the extent practicable	Medium	Medium	Moderate (in coarser seabed substrate habitat, likely not significant elsewhere)	Scoped In	N/A
Construction: direct and indirect seabed disturbances leading to the release of sediment contaminants	N/A	Negligible	Low	Not significant: Proctor 2004 noted that copper levels in the discharge brine were lower than the baseline seawater levels.	Scoped Out	Site-specific benthic surveys
Operational – long-term effects on benthic habitat of the footprint of infrastructure protruding above the seabed	N/A	Small	Medium	Minor (possibly offset by scour protection providing new or equivalent habitat)	Scoped In	Site-specific benthic surveys
Operational: long-term habitat loss/change due to saline discharge	N/A	Negligible/ Small	Medium	Minor	Scoped In	N/A
Operational: changes to seabed habitats arising from effects on physical processes, including scour effects and changes in the sediment transport and wave regimes	Anti-scour protection for the diffuser	Small	High	Minor	Scoped In	Site-specific benthic surveys

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
resulting in potential effects on benthic communities						
Operational: direct disturbance to shore and intertidal area from pipeline inspection and maintenance activities	N/A	Small	Low	Minor	Scoped In	N/A

7.4.6 Effects Scoped out of the EIA

7.4.6.1 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).

7.4.6.2 There is no evidence of sediment contamination in the area from previous surveys and there are no nearby industrial discharges to it. By virtue of its composition, initial dilution at the diffuser and secondary dispersion by ambient currents, the previous brine discharge was of a nature that would not have left a legacy of contamination in the sediments. Furthermore, the majority of fine sediments in the area (in which any contamination if present would be contained) undergo a regular process of resuspension, transport and settlement and so construction disturbance would be similar to the prevailing natural processes in terms of any potential contamination release from disturbed sediments.

7.4.6.3 The scope for accidental pollution events will be small and effectively limited to possible fuel oil release in the event of a vessel grounding or vessel-to-vessel collision. Accidental release of pollutants will be managed through implementing measures contained in an Emergency Response Plan (ERP), an outline of which will be provided in the ES).

7.4.7 Proposed Approach to the Assessment

7.4.7.1 The EIA will assess the potential impacts from construction, operational and decommissioning activities arising from the Proposed Development on the benthic and intertidal species and habitats identified within the study area and the desk-based review. The approach to EIA will follow the general approach outlined in **Chapter 5 EIA Methodology** of this Scoping Report.

7.4.7.2 For each effect on benthic fauna, the EIA will assess its significance. This will be done taking account of various factors to the extent they are relevant to the effect. These factors will include but not necessarily be limited to the following.

7.4.7.3 The nature, duration and magnitude of the impact:

- the degree of change from the baseline condition;
- duration, frequency, reversibility;
- ease / difficulty and likely effectiveness of mitigation methods; and
- size of area affected.

7.4.7.4 The nature of the affected receptors:

- importance or value for biodiversity or human resource use;
- extent to which important ecosystem functions are provided;
- sensitivity (of species, the ecosystem and sea users) to the impacts the Proposed Development will cause; and
- the extent to which there is exposure to a high-level of existing impact or likely future pressures leading to cumulative impacts.

7.4.7.5 Legal and policy considerations:

- compliance with relevant laws or regulations;
- potential for relevant standards or guidelines to be breached; and
- potential for conflict with relevant established policies or plans (e.g. for the MCZ).

7.4.7.6 For some impacts the magnitude will be quantified and compared with a numerical standard that is pertinent to the topic being assessed and where such a relevant standard exists. Assessing significance will then be simplified in terms of assessing whether a standard or limit may be breached (for example environmental quality standards for chemical components of the brine discharge).

7.4.7.7 In the absence of quantified standards to compare a quantified impact with, significance will be assessed based on a combination of the magnitude of impact experienced by a receptor and the receptor's characteristics in terms of:

- how the receptor responds to that impact (or its 'sensitivity' as a combination of tolerance, adaptability and recoverability), noting that sensitivity alone is not an inherent characteristic of a receptor and can vary from one type of impact to another (e.g. increased noise or elevated concentration of an aqueous pollutant); and
- the importance of the affected receptor, for example its level of protection or role in the ecosystem.

7.4.7.8 Where such qualitative and semi-quantitative approaches are applied the published evidence base and expert judgement will have key roles.

7.5 Fish and Shellfish Ecology

7.5.1 Introduction

7.5.1.1 This section of the Scoping Report identifies the fish and shellfish receptors of relevance to the Proposed Development and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore and shoreline components (i.e. temporary cofferdam) of the Proposed Development on fish and shellfish ecology. As discussed in **Section 7.4** Benthic and Intertidal Fauna and infaunal abundance and diversity across the Holderness coast is generally high. Approximately 230 fish species have been recorded in the North Sea as a whole (EEA, 2008).

7.5.2 Topic-specific Regulatory Requirements and Guidance

7.5.2.1 The topic-specific regulatory requirements and guidance is the same as those used for the assessment in **Section 7.3**.

7.5.3 Baseline Environment

Data Sources used in Scoping

7.5.3.1 A number of fish and shellfish datasets have been collated and a desktop review of publicly available data was undertaken to inform this Scoping Report. Baseline information was drawn from the study carried out by the Institute of Estuarine and Coastal Studies during November 2003 (IECS, 2004) and the assessment of potential environmental impacts from coastal works during construction and operation carried out August 2022 by the University of Hull (IECS, 2022). Studies discussed include Ellis et al. (2012) and Coull et al. (1998) and a detailed characterisation of the fish and shellfish communities within the Hornsea Zone, including the wider southern North Sea study area of the ES for Hornsea Project Three (Orsted, 2018).

Description

Demersal Fish

7.5.3.2 The Institute of Estuarine and Coastal Studies carried out a survey over an area that includes part of the Scoping Boundary during November 2003, identifying 32 species of fish from 12 demersal trawls and four pelagic trawls of which 15 % were identified as common throughout the area, 25 % were assessed as frequent, and the remaining 60 % considered a rare occurrence. Numerous datasets have been reviewed to assess demersal species potentially present within the offshore scoping boundary **(**Table 7.4).

Table 7.4: Demersal Species potentially present within the Scoping Boundary

Common Name	Scientific Name
Long rough dab	*Hippoglossoides platessoides*
Brill	*Scophthalmus rhombus*
Cod	*Gadhus morhua*
Dab	*Limanda limanda*
Dragonet	*Callionymus lyra*
Greater sandeel	*Hyperoplus lanceolatus*
Gurnard – Tub	*Trigla lucerna*
Gurnards – Grey	*Eutrigla gurnardus*
Haddock	*Melanogrammus aeglefinus*
Lemon sole	*Microstomus kitt*
Lesser spotted dogfish	*Scyliorhinus canicular*
Norwegian topknot	*Phrynorhombus norvegicus*
Plaice	*Pleuronectes platessa*
Pogge	*Agonus cataphractus*
Poor cod	*Trisopterus minutus*
Pouting	*Trisopterus luscus*
Reticulated dragonet	*Callionymus reticulatis*
Sandeels	*Ammodytes* spp.
Common / Dover Sole	*Solea solea*
Lemon Sole	*Microstomus kitt*
Solenette	*Buglossidium luteum*
Spotted ray	*Raja montagui*
Starry smooth-hound	*Mustelus asterias*
Stripped red mullet	*Mullus surmuletus*
Thickback sole	*Microchirus variegatus*
Thornback ray	*Raja clavata*
Whiting	*Merlangius merlangus*

Note: Only species which have been recorded within the Scoping Boundary are included in this table.

7.5.3.3 Typically, there is greater diversity farther offshore (beyond three miles, outwith the Scoping Boundary), with the exception of autumn and winter when cod and whiting move inshore to feed and a number of Pleuronectiforme species migrate into shallow water to spawn.

7.5.3.4 Plaice (and dover sole both have spawning grounds along the east coast of England, although there are no areas near the Scoping Boundary as they are farther offshore. Ellis et al. (2012) shows low intensity of plaice nursery grounds coinciding with the Proposed Development. Lemon sole nursery and spawning grounds are identified within the Proposed Development area; however, intensity is not defined.

7.5.3.5 With regards to whiting, there are no spawning areas within 150 km, although the inshore coastal waters support a large population of juvenile whiting (IECS, 2022). Ellis et al. (2012) concur with this assessment showing that cod and whiting nursery grounds overlap with the Proposed Development area, while spawning areas are farther offshore.

7.5.3.6 In recent years, seabass (*Dicentrarchus labrax)* has expanded its distribution in a northerly direction and is now considered common in inshore waters throughout the North Eastern Sea Fisheries Committee (NESFC) district (Donna Nook (Humber Estuary) to the River Tyne). Recent fisheries surveys carried out by the EA recorded juvenile bass in the nursery area of Humber Estuary, possibly indicating spawning areas close to the scoping boundary (IECS, 2022).

Pelagic Fish

7.5.3.7 Of the pelagic species in the region, mackerel (*Scomber scombrus*), herring (*Clupea harengus*) and sprat (*Sprattus sprattus)* are the most widely distributed. Although mackerel spawn offshore throughout the central North Sea, the inshore waters are within probable limits of spawning (Lee & Ramster, 1981). Datasets have been reviewed to assess pelagic species potentially present within the Proposed Development area.

Table 7.5: Pelagic Species Potentially Present within the Scoping Boundary

Common Name	Scientific Name
Atlantic horse mackerel	*Trachurus trachurus*
Herring	*Clupea harengus*
Mackerel	*Scomber sombrus*
Sprat	*Sprattus sprattus*

Note: Only species which have been recorded within the scoping boundary are included in this table.

7.5.3.8 The IECS (2004) survey found a relatively significant herring population inshore and across the Scoping Boundary although no spawning areas are considered close to the discharge area (IECS, 1993). Coull et al. (1998) suggests that the Scoping Boundary coincides with herring spawning grounds, in an area of low larval concentrations of 0.1 to 7,000 per m^2.

7.5.3.9 From data collected during the IECS (2003) survey, sprat was recorded as relatively common and widespread throughout the shallower areas of the region, and they migrate offshore to spawn from April to June and migrate inshore over-winter. No nursery areas have been identified throughout the area (Pawson & Robson, 1995).

Species of Nature Conservation Importance

7.5.3.10 Atlantic salmon *(Salmo salar*) and sea trout (*Salmo trutta*) migratory routes occur along the Holderness coastline, where the Humber Estuary acts as a route for migratory species to inland spawning areas. Salmonids use the Holderness coast as a migratory corridor to other estuaries on route to spawning rivers in the Esk and Tyne (IECS, 2022).

Shellfish

7.5.3.11 European lobster (*Homarus Gammarus*) and edible crab (*Cancer pagurus*) are both found throughout the Scoping Boundary which includes the existing brine discharge area (IECS, 2004). The IECS (2004) survey identified a large number of juvenile lobsters inshore and within the Scoping Boundary, although the density of adults above mean landing size (MLS) was low. Significant seasonal variation is a factor which will affect the distribution and ratios of juvenile and sub adults to adults above the MLS.

7.5.3.12 The IECS (2004) epifaunal survey indicates that the velvet crab (*Necora puber*) represents approximately 9% of the total crustacean assemblage across the inshore area. Both the whelk (*Buccinum undulatum)* and queen scallop (*Aequipecten opercularis*) were recorded during the 2003 survey of the site, although at extremely low densities. The datasets referenced in **Section 7.5.3.1** have been reviewed to assess shellfish species potentially present within the Proposed Development (Table 7.6**).**

Table 7.6: Shellfish Species potentially present within the Scoping Boundary

Common Name	Scientific Name
Brown crab	*Cancer pagurus*
Brown shrimp	*Crangon crangon*
European lobster	*Homarus gammarus*
Green crab	*Carcinus maenus*
King scallops	*Pecten Maximus*
Norwegian lobster	*Nephrops norvegicus*
Pink shrimp	*Pandulus montagui*
Queen scallop	*Aequipecten opercularis*
Squat lobster	*Munida rugosa*
Whelks	*Buccinum undatum*

Note: Only species which have been recorded within the Scoping Boundary are included in this table.

Brine Water Discharge

7.5.3.13 The Proposed Development will consist of up to nine underground caverns. These will be created by dissolving salt via the injection of seawater. To facilitate this, seawater will be abstracted offshore, flow via seabed pipeline to the 'wet well' landward of the cliffs, and from there used to leach the caverns. The resultant concentrated brine will be discharged back to sea. To maximise the dispersion of the brine discharge, a diffuser system will be employed at the end of the pipe.

7.5.3.14 The discharge of brine into the sea will have a localised impact on the biota in the water column, and benthic fauna and epifaunal in the area will be directly affected by the saline discharge plume due to physico-chemical alterations to the water column and seabed sediments. The mobile fauna, such as pelagic and demersal fishes, have the ability to migrate away from any unfavourable water quality and seabed conditions. Sessile fauna invertebrates cannot migrate and therefore will not survive high saline conditions. The presence of the saline discharge plume may restrict movements of some mobile fauna in the immediate area of the discharge.

7.5.3.15 It is therefore considered that whilst there will be a degree of impact on the marine fauna adjacent to the points of discharge, these impacts would be restricted to at most an area of

around 63 by 63 m (4,000 m^2) (Proctor, 2004). With an extensive diffuser system such as that previously employed, the salinity elevation will be minimal and mostly within natural variability within tolerance levels for the coastal organisms. Out with this area, loadings will have received sufficient dilution such that that they are below the level of environmental effect for most species, and with these areas only receiving elevated salinity levels for a partial duration of the tidal cycle. As such, no long-term or irreversible effects on the marine ecology of the area would be expected from the discharge of brine water. However, the potential exists for some short-term variation in the composition of the fauna, and most specifically, to shellfish in the area, in the immediate vicinity of the discharge. Therefore, as part of the mitigation and monitoring for the Proposed Development, a survey and assessment of the scale of effects on shellfish will be undertaken.

Key Sensitivities

7.5.3.16 The key fish and shellfish receptors within the study areas are identified as follows:

- demersal species such as whiting, cod, dab, plaice and lemon sole;
- pelagic species such as herring, sprat and mackerel;
- sandeel species;
- benthic shellfish species of brown crab, lobster, and velvet swimming crab;
- elasmobranch species such as the lesser spotted dogfish, thornback ray, spotted ray, and starry smooth-hound; and
- migratory salmonids such as Atlantic salmon, trout and European eel.

7.5.3.17 Therefore, site specific baseline characterisation surveys of fish and shellfish will likely need to be carried out to identify any sensitive receptors such as spawning areas within the Proposed Development.

Table 7.7: Spawning and nursery areas of fish and shellfish species in the vicinity of the Scoping Boundary

Species	Spawning area overlap	Nursery area overlap
Brown Crab	Partial overlap	No overlap
Cod	No overlap	High intensity
Haddock	No overlap	No overlap
Herring	Low intensity	High intensity
Lemon sole	Low intensity	Low intensity
Mackerel	Low intensity	No overlap
Norway lobster	Partial overlap	No overlap
Plaice	High intensity	Low intensity
Sandeel	No overlap	Partial overlap
Sole	Low intensity	No overlap
Sprat	Low intensity	Low intensity
Whiting	No overlap	Low intensity

Source: EIA for Hornsea Project Three (Orsted, 2018). Data from: Coull et al., (1998); Ellis et al., (2012) and Eaton et al., (2003)

7.5.4 Project Basis for Scoping Assessment

7.5.4.1 The assessment of construction impacts is based on the maximum case made up of following:

- installation (and subsequent removal) of a temporary cofferdam on the foreshore to tie in the pipes horizontally directionally drilled from land to the seabed pipes;
- trenching, laying and backfilling new seabed pipes;
- install a new diffuser and a new seawater intake (i.e. the structure that on the seaward end of the seawater intake pipe); and
- provision of anti-scour protection as required.

7.5.4.2 Effects associated with the operational brine discharge have been considered in the context of monitoring the effects of the AGS brine discharge as described above.

7.5.5 Mitigation

7.5.5.1 Mitigation measures will be broadly similar to those described in **Section 7.4.4** for benthic ecology. In addition, entrainment of fish and shellfish during seawater abstraction will be minimised through control of seawater abstraction rates and the design of the seawater intake.

7.5.6 Likely Significant Effects to be Considered in the EIA

7.5.6.1 Table 7.8 provides an assessment of the effects on fish and shellfish ecology at the scoping stage of the EIA process. The assessment is based on the envelope defined in the **Chapter 2 Proposed Development Description,** embedded mitigation measures if applicable, the evidence for potential effects, relevant policy, and the assessment criteria provided in **Chapter 5 EIA Methodology**.

7.5.6.2 Table 7.8 sets out a high-level assessment of all the potential significant effects and defines which are to be scoped into the EIA. Construction and operational effects are outlined in Table 7.8; however decommissioning effects are anticipated to be no worse than construction effects and will be accordingly assessed where necessary and to the extent it is practicable to do so at the EIA stage in the absence of a decommissioning plan. Any decommissioning works will be subject at the time to its own assessment and Marine Licence application.

Table 7.8: Likely Effects – Fish and Shellfish Ecology

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction: Physical damage and disturbance to mobile demersal fish and shellfish species.	N/A	Negligible	Medium	No likely significant effects	Scoped Out	None
Construction: Noise disturbance to fish	No specific measures, but will benefit from those for marine mammals	Minor	Medium	Minor	Scoped In	None
Construction: Temporary localised increases in suspended sediment concentration (SSC) and smothering.	N/A	Small	Medium	Minor	Scoped In	None
Construction: Seabed disturbances leading to the release of sediment contaminants.	N/A	Negligible	Low to Medium	No likely significant effects, previous assessments of brine discharge indicate minimal legacy contaminants AGS brine discharge. See also **Section 7.3**	Scoped Out	None
Operation: impacts on water quality from the discharge of brine	Control of release rate and design of diffuser	Small	Medium	Minor	Scoped In	None
Operation: Increased hard substrate and structural	N/A	Negligible	Low	No likely significant effects.	Scoped Out	None

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
complexity as a result of the presence of the diffuser and anti-scour provisions.						
Operation: physical disturbance resulting from maintenance during operation.	N/A	Negligible	Low to Medium	No likely significant effects.	Scoped Out	None
Operation: effects resulting from the accidental release of pollutants.	N/A	Negligible	Low to Medium	No likely significant effects.	Scoped Out	None
Operation: Reduced fishing pressure within the diffuser area and increased fishing pressure outside the area due to displacement.	N/A	Fleet dependent; up to Small	Fleet dependent; up to Medium	Minor significant effect. Although the effect will be long-term, the operational range of fishing vessels is not limited to the area.	Scoped In. An assessment approach will be adopted for the assessment of this impact during construction that includes consultation with local fishers.	Gather up-to-date publicly available data and consultations with active fleets.

7.5.7 Effects Scoped Out of the EIA

7.5.7.1 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).

Construction

Direct damage and disturbance to mobile demersal fish and shellfish species

7.5.7.2 The impacts associated with direct damage and disturbance from construction activities will be of local extent, short term duration and reversible. It will affect a small proportion of the Scoping Boundary for a temporary period. Mobile species that will be subject to disturbance can move away from construction activities. The habitats disturbed represent a small area of the total distribution of that habitat type present in the central southern North Sea, based on regional datasets. Therefore, the magnitude is considered to be negligible.

7.5.7.3 Most fish and shellfish receptors in the study area are deemed to be of low vulnerability, high recoverability and of local to international importance within the study area. The sensitivity of these receptors is considered to be low.

7.5.7.4 Brown crab, European lobster and Norway lobster are deemed to be of high vulnerability, medium to high recoverability and of regional importance within the study area. Further, sandeel and herring are deemed to be of high vulnerability, medium recoverability and of regional importance within the study area. The sensitivity of these receptors is considered to be medium.

7.5.7.5 For all species it is considered that there is no risk of likely significant effect, and it is proposed that this effect be scoped out of the EIA.

Accidental pollution events resulting in potential effects on fish and shellfish receptors

7.5.7.6 The scope for accidental pollution events will be small and effectively limited to fuel oil release in the event of a vessel grounding or vessel-to-vessel collision. Accidental release of pollutants will be managed through implementing measures contained in an ERP, an outline of which will be provided in the ES). Any pollutants would be limited to the inventory present on construction vessels, and in the event of a spill would be contained or disperse quickly. With good on-board vessel practice measures in place, the likelihood of an incident taking place is very low. Therefore, the magnitude is considered to be negligible.

7.5.7.7 Sensitivity to pollution of fish and shellfish varies due to lifecycles and behaviour. Highly mobile species are generally less sensitive to pollution; however, less mobile species, eggs and larvae are more likely to have high sensitivity. Species identified within the Scoping Boundary with the potential to bioaccumulate toxins through trophic levels have increased sensitivity. Species within the Scoping Boundary are considered to have low to medium sensitivity. For all species it is considered that there is minimal risk of likely significant effect, and it is proposed that this impact be scoped out of the EIA.

Operation

Direct disturbance resulting from maintenance

7.5.7.8 Disturbance from operation and maintenance activities will have a local extent and will be intermittent of short duration. Therefore, the magnitude is considered to be negligible. As stated above, the sensitivity of species present within the Scoping Boundary varies from

low to medium. For all species it considered that there is no risk of likely significant effect, and it is proposed that this impact be scoped out of the EIA.

Accidental release of pollutants resulting in potential effects on fish and shellfish receptors

7.5.7.9 An ERP will be developed to respond to accidental events such as fuel oil spills during maintenance. Any pollutants would be limited to the inventory present on maintenance vessels, and in the event of a spill would disperse quickly. Therefore, the magnitude is considered to be negligible. Sensitivity of fish and shellfish will range from low to medium. For all species it considered that there is minimal risk of likely significant effect, and it is proposed that this impact be scoped out of the EIA.

7.5.8 Proposed Approach to the Assessment

7.5.8.1 The EIA will assess the potential effects from construction and operational activities arising from the Proposed Development on species identified within the study area and the desk-based review. The approach to EIA will follow the general approach outlined in **Chapter 5 EIA Methodology** of this Scoping Report.

- Species sensitivities will be derived based on the importance of the Scoping Boundary to specific periods of vulnerability within a species life history as stated previously. The sensitivity will also consider the hearing sensitivity of each species as reported by Popper et al. (2014). Fish will be assigned to one of four categories depending on the species hearing ability. An assessment will then be made taking into consideration potential injury and disturbance of each species and based on the outputs of the detailed noise modelling.
- The likely effects of the brine discharge will be considered based on modelling the size of the mixing zone around the diffusers and the evidence base from long-term monitoring of the AGS discharge.

7.6 Marine Mammals

7.6.1 Introduction

7.6.1.1 This section of the Scoping Report identifies the marine mammals of relevance to the Proposed Development and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore and shoreline components (i.e., temporary cofferdam) on marine mammals.

7.6.2 Topic Specific Regulatory Requirements and Guidance

7.6.2.1 This section outlines the regulatory and guidance relevant to potential impacts on marine mammals due to construction, operation, and decommissioning of the Proposed Development.

Habitats Directive and European Protected Species

7.6.2.2 All cetaceans present within the North Sea are listed as European Protected Species (EPS) under Annex IV of the EU Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (known as The Habitats Directive). Additionally, harbour seal *(Phoca vitulina*), grey seal (*Halichoerus grypus*), harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncates)* have protections under Annex II as a species of Community Interest whose conservation warrants the designation of SACs.

7.6.2.3 The Habitats Directive is transposed into UK law through the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 for territorial waters out to 12 nm and

transposed through the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2017 for offshore waters beyond 12 nm. The Habitats Directive provide European level protection SACs, as part of the Natura 2000 network.

Wildlife and Countryside Act (1981 as amended)

7.6.2.4 The Wildlife and Countryside Act makes it an offence to kill, injure or take any fauna listed on Schedule 5, and prohibits interference with key habitats for these species. All cetacean species are protected within territorial waters (12 nm) under Schedule 5 of the Wildlife and Countryside Act.

The UK Marine Policy Statement

7.6.2.5 The UK Marine Policy Statement is the framework for preparing Marine Plans and taking decisions affecting the marine environment. The high-level objective 'Living within environmental limits' includes the following requirements relevant to marine mammals:

- biodiversity is protected, conserved and where appropriate, recovered and loss has been halted;
- healthy marine and coastal habitats occur across their natural range and are able to support strong biodiverse biological communities and the functioning of healthy, resilient, and adaptable marine ecosystems; and
- our oceans support viable populations of representative, rare, vulnerable, and valued species.

UK Biodiversity Action Plan and the UK Post-2010 Biodiversity Framework (2012)

7.6.2.6 The UK Biodiversity Action Plan (UK BAP) was published in 1994 following the 1992 Rio de Janeiro Convention on Biological Diversity. The UK BAP identifies biological resources in the UK and plans for their conservation. This was succeeded by the UK Post-2010 Biodiversity Framework in 2012 in response to the Convention on Biological Diversity's Strategic Plan for Biodiversity 2011-2020 and the EU Biodiversity Strategy 2011. The UK Post-2010 Biodiversity Framework describes how the UK can meet the Aichi Biodiversity Targes. The UK BAP identified priority species which are threatened and require conservation. These priority species include all cetacean and pinniped species in UK waters.

East Inshore and East Offshore Coast Marine Plans

7.6.2.7 The East Inshore Marine Plan area covers the east coast coastline out to 12 nm. The East Offshore Marine Plan is adjacent to the East Inshore Marine Plan but extends out in offshore waters greater than 12nm from the coast. Objectives of these marine plans which concern marine mammals includes:

- Objective 6: To have a healthy, resilient and adaptable marine ecosystem in the East Marine Plan Areas (MPAs);
- Objective 7: To protect, conserve and, where appropriate, recover biodiversity that is in or dependent upon the East (MPAs); and
- Objective 8: To support the objectives of MPAs (and other designated sites around the coast that overlap with, or are adjacent to, the East MPAs), individually and as part of an ecologically coherent network.

Marine Strategy Framework Directive

7.6.2.8 The MSFD 2008/56/EC aims to achieve Good Environmental Status (GES) of the EU's marine waters and to protect the resources which marine related economic and social activities depend. This directive was transposed into UK law through the Marine Strategy Regulations 2010. Annex I of the MSFD includes the following requirements that are relevant to marine mammals:

- biological diversity is maintained.
- the quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic and climatic conditions.
- all elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.
- concentrations of contaminants are at levels not giving rise to pollution effects.
- introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

Conservation of Seals Act, 1970

7.6.2.9 The Conservation of Seals Act (1970) makes it an offence to take or kill any seal during key seasons unless licenced to do so. Since 1999, an order was issued under the Conservation of Seals Act providing year-round protection to harbour seals and grey seals on the east and south coast of England, including the Proposed Development Area (under the Conservation of Seals (England) Order 1999).

Bonn Convention

7.6.2.10 The Convention of the Conservation of Migratory Species of Wild Animals (the Bonn Convention) requires members to implement strict legal protections for endangered migratory species (Appendix I) and migratory species which would benefit from multilateral agreements for conservation and management (Appendix II). No Appendix I species are commonly found in the North Sea, however, Appendix II species most commonly found in the North Sea include bottlenose dolphin, white-beaked dolphin (*Lagenorhynchus albirostris*), common dolphin (*Delphinus delphis*), harbour porpoise, and Risso's dolphin (*Grampus griseus*).

Bern Convention

7.6.2.11 The convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) broadly aims to ensure conservation and protection of wild fauna, flora and their habitat, listed in Appendix I, II and III of the convention. There are 19 species of cetacean listed under Appendix II of the Bern Convention including bottlenose dolphin, white-beaked dolphin, common dolphin, harbour porpoise, Risso's dolphin and minke whale (*Balaenoptera actutorostrata*). All other cetaceans as well as harbour seal and grey seal are listed under Appendix III. The Bern Convention is transposed into UK law through the Wildlife and Countryside Act (1981 as amended).

7.6.3 Baseline Environment

Data Sources Used for Scoping

7.6.3.1 A desk-based review of literature and existing data sources was undertaken to support this Scoping Report. The data sources listed and summarised below cover the AHS offshore area.

- **SCANS III.** The SCANS III survey provides regional scale cetacean data with a density estimate for the survey bloc containing the AHS project, which was surveyed in July 2017.
- **Waggit et al. (2019).** Seasonal, regional level, distribution maps were created for the most common cetaceans in the north-east Atlantic from systematic aerial surveys. This includes interpolated animal densities.
- Haul out data will also be included in the PEIR and ES but was not available for scoping assessment.

Description

7.6.3.2 Pinniped species found within the Proposed Development area are the grey seal and harbour seal. Common cetaceans found within the Proposed Development area include white-beaked dolphin, harbour porpoise, and minke whale. Less common species, include Risso's dolphin, bottlenose dolphin, common dolphin, Atlantic white sided dolphin (*Lagenorhynchus acutus*), long-finned pilot whale (*Globicephala melas*), and orca (*Orcinus orca*) (Waggit et al., 2019). According to Waggit et al. (2019), harbour porpoises are the most common species of cetacean found in the central North Sea and around the Proposed Development, followed by white-beaked dolphin.

Table 7.9: Characteristics of the most represented marine mammal species in the central North Sea

Species	International Union for Conservation of Nature (IUCN) Status (Europe)/ local population trend	Biology and geographical distribution
Grey seal	Least Concern Increasing	***Food:*** Their feeding behaviour can be demersal or benthic. Sandeels, cod and saithe all account for a typical grey seal diet, which varies depending on availability. ***Habitat:*** Present in the North Atlantic continental shelf, in cold temperate waters. Population size is estimated at 315,000 adults.
Harbour seal	Least Concern Increasing	***Food:*** Fish, cephalopods and crustaceans caught at water surface, mid waters and on sea bottom. ***Habitat:*** Typically in the coastal waters of continental shelf and slopes. Population size is estimated at 600,000 individuals.
Minke whale	Least Concern Stable	***Food:*** Minke whale exploit a variety of prey depending on availability, but usually consume a considerable amount of krill. ***Habitat:*** The minke whale is found in all oceans, and part of the population is believed to migrate to warmer latitudes every winter. Total population estimates reach 200,000 individuals.
Harbour porpoise	Vulnerable Decreasing	The species is listed in Appendix II of CITES. Food: Wide variety of fish and cephalopods. Habitat: Typically found in continental shelf waters in cold temperate to sub-polar waters of the Northern Hemisphere. They frequently visit shallow waters of estuaries, tidal channels and shallow bays. The population comprises 700,000 individuals, although it is declining.
White-beaked dolphin	Least Concern Stable	Food: Small pelagic fish, squid and crustaceans. Habitat: Typically found in waters less than 200 m deep, lives in cold temperate to subpolar zones. Total Atlantic populations are estimated at more than 100,000.

Source: Prepared by ERM with data extracted from IUCN. (2020) and Waggit et al. (2019).

7.6.3.3 Large-scale surveys for cetaceans in the North Sea were carried out in 1994 (SCANS I - Small Cetaceans Abundance in the North Sea), 2005 (SCANS II) and SCANS III (2016). The SCANS III data provides estimates of cetacean abundance in European Atlantic waters in summer 2016 from aerial and shipboard surveys (Hammond et al., 2017).

7.6.3.4 The 2016 SCANS III survey found that the observed distribution of minke whale, harbour porpoise and white-beaked dolphin in 2016 were similar to those observed in SCANS-II in 2005 (Hammond et al., 2017). One notable difference was that there were more sightings of harbour porpoise throughout the English Channel (Block C) in 2016 than in previous years.

7.6.3.5 Comparing results from the three surveys has allowed for analysis of trends of abundance. In the North Sea, harbour porpoise, white-beaked dolphin and minke whale abundance has not changed since 1990 (Hammond et al., 2017). A more recent study, however, shows a 1.79% decline in harbour porpoise abundance per year in the German North Sea, but a slight increase in southern areas of the North Sea. The study concludes that underlying causes and drivers for the large decline remain unknown and deserve further investigation, also in a North Sea wide context (Nachtsheim et al., 2021).

7.6.3.6 Observations between 1980 and 2018 showed that most species of cetacean found in the central North Sea (i.e., minke whale, white-beaked dolphin, harbour porpoise, short-beaked dolphin, Atlantic white-sided dolphin and Risso's dolphin) are more abundant in the North Sea during summer months compared to winter months (Waggitt et al., 2019). Killer whale and long-finned pilot whale show no seasonality pattern.

Key Sensitivities

7.6.3.7 Marine mammals face threats and pressures that can affect population levels. Any threat to marine mammal abundance can be attributed to a range of human induced pressures (IECS, 2019) such as:

- feeding habitat can be degraded by bottom trawling, sand and gravel extraction and dredging activities damaging the seabed;
- underwater noise can adversely impact marine mammals' ability to communicate, feed, navigate and reproduce;
- offshore developments that span over large areas (particularly windfarms and wave and tidal arrays) can be a barrier to local movement and regional migration due to an avoidance of construction and operational noise levels;
- marine mammals, particularly large cetaceans, are vulnerable to collisions with ships; and
- prey depletion adversely affects marine mammals, with harbour porpoises particularly vulnerable to prey depletion due to their high energy requirements.

7.6.4 Project Basis for Scoping Assessment

7.6.4.1 The marine mammal scoping assessment was based on the following maximum design scenario:

- construction of a nearshore cofferdam, potentially involving steel sheet piling, and its removal at the end of construction;
- laying of new pipelines from the cofferdam to abstraction point and diffuser;
- installation of a diffuser; and

- pre-construction geotechnical and geophysical surveys.

7.6.5 Mitigation

7.6.5.1 The Proposed Development will apply standard good practice measures for the protection of marine mammals throughout the construction phase including a vessel management plan which will determine vessel routing to and from construction areas and ports to avoid areas of high risk. This will include codes of conduct regarding maximum vessel speeds and any vessel interaction with marine mammals, such as animals approaching the bow to bow-ride.

7.6.5.2 If any form of piling is required (e.g. for installing the temporary foreshore cofferdam), a marine mammal observer and passive acoustic monitoring (PAM) operator will be present on board the construction vessel. Soft start procedures will also be adopted.

7.6.6 Likely Significant Effects to be Considered in the EIA

7.6.6.1 Table 7.10 provides a high-level assessment of the effects on marine mammals at the scoping stage of the EIA process. The assessment is based on the envelope defined in the **Chapter 2 Proposed Development Description,** embedded mitigation measures if applicable, the evidence for potential effects on marine mammals, relevant policy, the assessment criteria provided in **Chapter 5 EIA Methodology** and the professional judgement of qualified marine ecologists.

7.6.6.2 Table 7.10 sets out a high-level assessment of all the potential significant effects and defines which are to be scoped into the EIA. Construction and operational effects are outlined in Table 7.10; however decommissioning effects are anticipated to be no worse than construction effects and will be accordingly assessed where necessary and to the extent it is practicable to do so at the EIA stage in the absence of a decommissioning plan. Any decommissioning works will be subject at the time to its own assessment and Marine Licence application.

Table 7.10: Likely Effects – Marine Mammals

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction Phase: Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) effects on hearing from piling (if required e.g. sheet piling for the cofferdams), geotechnical surveys and unexploded ordnance (UXO) clearance.	JNCC Guidance on geotechnical surveys (Soft starts, MMO, PAM, ADDs etc.)	Small	Medium	Minor significance through a combination of duration and mitigation measures available.	Scoped In. The assessment approach will involve the calculation of the area affected by underwater noise which will be overlain on species specific density surfaces to estimate the number of animals affected as a proportion of the regional population.	None
Construction Phase: disturbance from geotechnical surveys and UXO clearance leading to behavioural effects.	JNCC Guidance on geotechnical surveys (Soft starts, MMO, PAM, ADDs etc.)	Small	Medium	Minor significance evidence from telemetry and acoustic detection data at offshore wind farm projects, for example, shows animals are displaced by underwater noise but return after it ceases	Scoped In. As above.	None
Construction Phase:	A vessel management plan will be developed which will determine	Negligible (very low likelihood of occurrence and will	Medium	Not significant	Scoped In. The assessment will describe	

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
vessel collision risk	vessel routing to and from construction areas and ports to avoid areas of high risk.	not add noticeably to an existing level of risk from commercial and fishing vessels)			vessel management and risk reduction measures	
Construction Phase: disturbance from vessel movements	A vessel management plan will be developed which will determine vessel routing to and from construction areas and ports to avoid areas of high risk.	Small	Medium	Minor significant effect without secondary mitigation. It is not expected that there will be a significant increase in vessel activity over the baseline levels.	Scoped In. A simple assessment approach will be adopted involving an assessment of how vessel activity in the area is predicted to increase during construction activities and existing evidence on marine mammal responses to vessel presence.	Data on baseline vessel activity required
Construction Phase: non-piling noise (pipeline installation, dredging etc.)	None.	Small	Medium	Minor significant effect. It is unlikely that these activities will affect marine mammal receptors at anything other than the immediate proximity.	Scoped Out.	None
Operation Phase: disturbance from vessels	A vessel management plan will be developed which will determine vessel routing to and from operational areas	Negligible	Low	Not significant	Scoped Out.	None

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
	and ports to avoid areas of high risk.					
Operation Phase: vessel collision risk	A vessel management plan will be developed which will determine vessel routing to and from operational areas and ports to avoid areas of high risk.	Negligible	Low	Not significant	Scoped Out.	None
Operation Phase: Pumping brine through the pipeline	None.	Small	Medium	Minor significant effect. It is unlikely that these activities will affect marine mammal receptors at anything other than the immediate proximity.	Scoped Out	None

7.6.7 Effects Scoped Out of the EIA

7.6.7.1 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).

Construction noise

7.6.7.2 It is unlikely that construction noise from non-piling activities will affect marine mammal receptors at anything other than in the immediate proximity, i.e. a negligible fraction of their range. Therefore, it is proposed that non-piling construction noise is scoped out of assessment of marine mammals.

Operational noise

7.6.7.3 Operational noise from pumping of seawater and/or brine through the pipeline is expected to be low (since the pump will be located on land, and therefore the magnitude of potential impact and area of influence is estimated to be negligible. It is proposed that operational noise from pumping of seawater is scoped out of assessment of marine mammals.

Operational disturbance and collision risk from vessels

7.6.7.4 A vessel management plan will be developed which will determine vessel routing to and from operational areas and ports to avoid areas of high risk. Therefore, it is proposed that operational disturbance and collision risk from vessels is scoped out of assessment of marine mammals.

Reduction in prey availability

7.6.7.5 Marine mammals prey on fish, crustacea and plankton and there is the potential for secondary effects of reduced prey availability due to impacts on prey species and supporting habitats. However, since no significant effect is expected on prey, populations or habitats, it is reasonable to assume that no significant secondary effects on marine mammals will occur. Therefore, it is proposed that a reduction in prey availability is scoped out of assessment of marine mammals.

Reduction in foraging ability due to suspended sediment

7.6.7.6 Visual impairment due to suspended sediment might be expected which could in turn reduce foraging success. However, it is not expected that there will be a significant increase in suspended sediment as a result of construction, operation or decommissioning. Additionally, marine mammals are known to forage in areas of poor visibility, such as tidal flows (Pierpoint, 2008; Marubini et al., 2009, Hastie et al., 2016) and the area in the Scoping Boundary has regular episodes of natural high turbidity.

7.6.8 Proposed Approach to Assessment

7.6.8.1 The following section provides an overview of the proposed impact assessment methodology that will be adopted for marine mammals. This includes PTS and TTS thresholds and the proposed approach to the disturbance assessment. The Southall et al. (2019) thresholds will be used to assess the risk of PTS and TTS from construction of the cofferdams and possible UXO clearance noise[i]. This will use weighted, cumulative, sound exposure levels (SEL_{cum}) and unweighted peak sound pressure levels (SPL). However, it should be noted that if the MMO advises that UXO clearance marine licenses should be applied for separately to the DCO application, then underwater noise modelling will not

need to be undertaken for this aspect. Regarding the approach to assessing significant effects this will be broadly as set out in **Chapter 5 EIA Methodology**.

Table 7.11: PTS and TTS Onset Thresholds

Species	PTS Threshold SEL (weighted) decibels relative to one micro Pascal square second (SELcum)	TTS Threshold SEL (weighted) decibels relative to one micro Pascal square second (SELcum)
Harbour porpoise	155	140
Harbour and grey seal	185	170

Source: Southall et al. (2019).

Table 7.12: PTS Onset Thresholds

Marine Mammal Hearing Group	Species	PTS onset: SEL (weighted) decibels relative to one micro Pascal square second (SELcum)	PTS onset: Peak SPL (unweighted) decibels relative to one micro Pascal square second (peak)
Low Frequency (LF)	Minke whale	183	219
High Frequency (HF)	White-beaked dolphin	185	230
Very High Frequency (VHF)	Harbour porpoise	155	202
Earless Seals (PCW)	Grey seal and harbour seal	185	218

Source: Southall et al. (2019).

Table 7.13: TTS Onset Thresholds

Marine Mammal Hearing Group	Species	TTS onset: SEL (weighted) dB re 1 μPa^2s (SELcum)	TTS onset: Peak SPL (unweighted) dB re 1 µPa (peak)
Low Frequency (LF)	Minke whale	168	213
High Frequency (HF)	White beaked dolphin	170	224
Very High Frequency (VHF)	Harbour Porpoise	140	196
Earless Seals (PCW)	Grey Seal and Harbour Seal	170	212

Source: Southall et al. (2019)

Table 7.14: Behavioural Disturbance Threshold

Sound type	Behavioural disturbance threshold	Species
All marine mammals	Impulsive	145 dB re 1 μPa^2s (single-pulse unweighted SEL)

Sound type	Behavioural disturbance threshold	Species
	Non-impulsive	120 dB re 1 µPa (unweighted rms SPL)

7.6.8.2 Detailed analysis of additional datasets will be utilised to further characterise the spatial and temporal distribution of marine mammals across the area and predict the potential effects upon the populations.

7.6.8.3 Potential disturbance and displacement of marine mammals from vessel movement and geotechnical surveys will be assessed using likely vessel routes and area affected by noise in relational to likely marine mammal density. Similarly, collision risk will be assessed using vessel movement corridors, operating conditions and marine mammal density.

7.7 Marine Archaeology

7.7.1 Introduction

7.7.1.1 This section outlines the scope for the archaeological assessment of the Marine Infrastructure. It begins with a summary of legislation and guidance, a brief methodology and an explanation of the Study Area. An overview of baseline conditions focused on known heritage assets both within the Scoping Boundary and within 2 km of the Scoping Boundary is then provided. Key sensitivities and the basis for assessment are described, and the potential for mitigation and likely significant effects summarised. It concludes by outlining a proposed approach to baseline gathering and impact assessment.

7.7.2 Topic-specific Regulatory Requirements and Guidance

7.7.2.1 The national and international policy and legislation specifically relating to marine archaeology and cultural heritage used to conduct this assessment is as follows:

- UNESCO. 2001. UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001. UNESCO: Paris[99];
- United Nations. 1982. United Nations Convention on the Law of the Sea (UNCLOS) 1982. Division for Ocean Affairs and the Law of the Sea;
- The UK Government. 2011. *UK Marine Policy Statement.* The UK Government: Westminster[100];
- The UK Government. 2009. *UK Marine and Coastal Access Act 2009*. The UK Government: Westminster; and
- The UK Government 1973. Protection of Wrecks Act 1973 in the English Territorial Sea[101]
- The industry specific best practice and guidance specifically relating to archaeology and cultural heritage used to conduct this assessment is as follows:
- Charted Institute for Archaeologists (2020) Standard and Guidance for Archaeological Excavation[102]; and
- Historic England (2015) Assessing England's Protected Wreck Sites[103].

[99] http://unesdoc.unesco.org/images/0012/001260/126065e.pdf

[100] 10164_Marine Statement_Cov.indd (publishing.service.gov.uk)

[101] . http://www.un.org/depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm

[102] Accessible at: CIfAS&GExcavation_2.pdf (archaeologists.net)

[103] https://historicengland.org.uk/images-books/publications/accessing-englands-protected-wreck-sites-guidance-notes/

7.7.3 Baseline Environment

Data sources used in Scoping

7.7.3.1 The data sources utilised for this assessment include:

- Historic England (National Heritage List) for information on World Heritage Sites and Protected Wrecks;
- readily accessible published sources and grey literature (e.g., results from previous studies);
- relevant published and grey literature historic environment reports;
- HM Revenue and Customs Land, buildings and their contents for tax-exempt heritage assets[104]; and
- Admiralty Maritime Data Solution Marine Data Portal by the UKHO.

Description

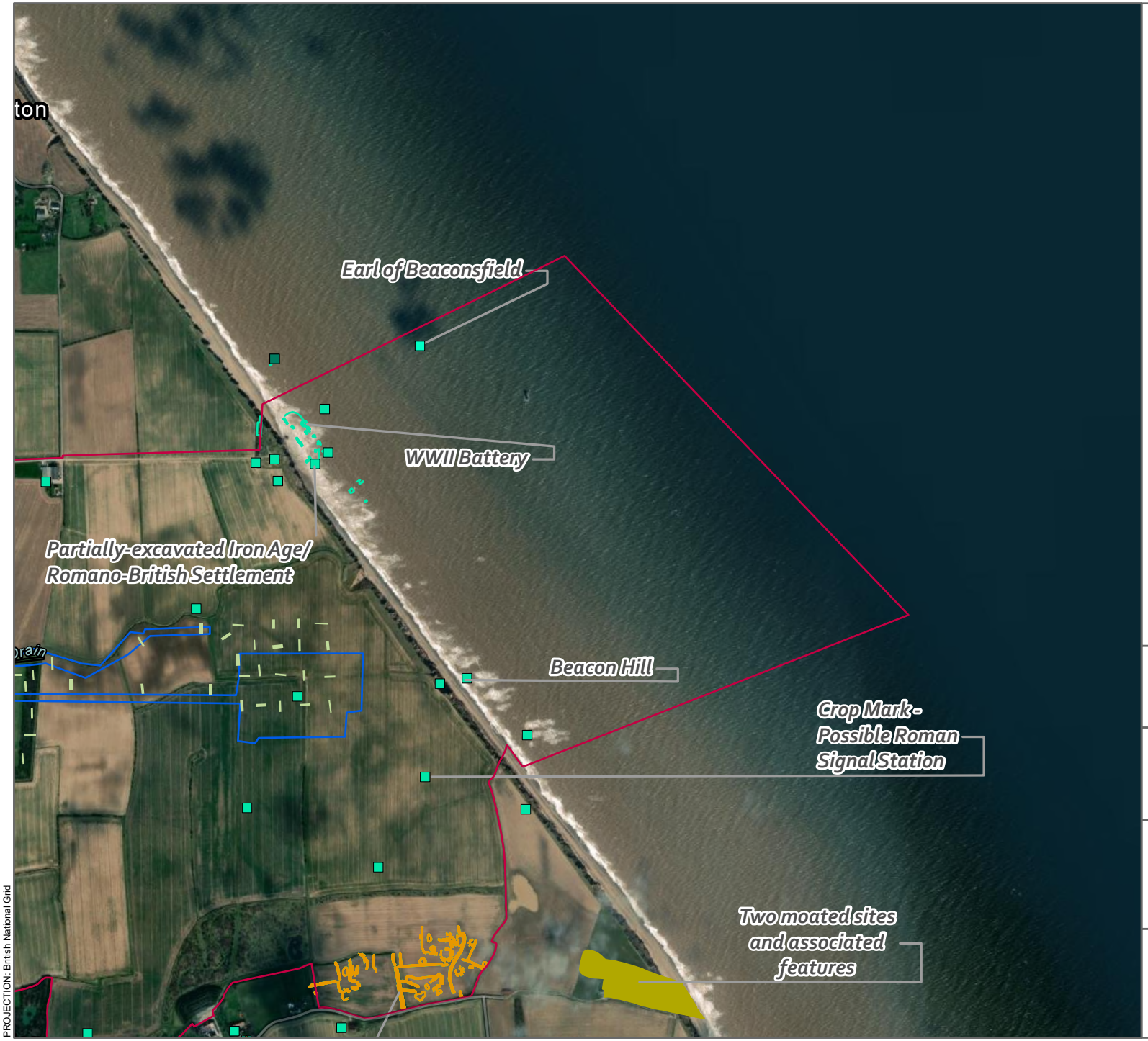
Designated Assets

7.7.3.2 There are no designated protected shipwrecks or world heritage sites within the scoping boundary. There are, however, three recorded wrecks mapped by the UKHO (Figure 7.5**),** including the locally well-known Victorian shipwreck, the Earl of Beaconsfield, located just 500 m offshore and 360 m north-west of the existing monopile (Figure 7.7).

7.7.3.3 Within 2 km of the Marine Infrastructure Scoping Boundary there are the following designations:

- Two recorded wrecks mapped by the UKHO (Figure 7.6); and
- No designated protected wreck sites.

[104] Accessible at HM Revenue & Customs: Land, buildings and their contents - search (hmrc.gov.uk).



Scoping Boundary

Previous Work

AOC Archaeological Monitoring (2008)

AOC Trial Trenching (2008)

ASWYAS Geophysical Survey (2006)

Designated Assets

Listed Building

Grade

I

II

Scheduled Monument

Non Designated Assets

Deserted Medieval Villages

Non Designated Point

Deserted Medieval Villages - Grimston

Non Designated Linear

Non Designated Area

0 100 200 300 400 500

Metres

N

SCALE: See Scale Bar	VERSION: A04
SIZE: A4	DRAWN: GB/HD
PROJECT: 0630444	CHECKED: MW
DATE: 09/05/2023	APPROVED: ES

Figure 7.6
Shipwrecks and Other Known Cultural Heritage Sites

ERM

equinor

PROJECTION: British National Grid

Path: \\uksprdgisfs01\Data\London\Projects\0630444 - Equinor Aldbrough Hydrogen\MAPS\0630444 - Equinor Aldbrough FIGURES.aprx\0630444 - CH - Previous Work Marine - A04

Figure 7.7: Earl of Beaconsfield and Monopile in Background[105]

Non-designated assets and archaeological potential

7.7.3.4 Since the 1930s prehistoric artefacts have been recovered during fishing expeditions off the Holderness Coast, but only as a result of intensive research over the last two decades has it become clear that well preserved submerged prehistoric land surfaces of high archaeological and palaeoenvironmental potential survive all along the southern North Sea coastline. The Holderness coastline lies on the western edge of the former landsurface, known as Doggerland, that connected the British Isles with the continent prior to Holocene Sea level rise, and where recent research has identified a high potential for locating Middle and Upper Palaeolithic and Mesolithic sites[106].

7.7.3.5 The changing coastline, caused by rising sea levels and erosion, means that much of the evidence of past human occupation of the Holderness coast lies in the offshore and nearshore (intertidal) zone. Documentary and map evidence locates the remains of former villages including old Ringbrough and Monkwell, located 500 m and 1 km offshore, respectively.

7.7.3.6 The collapsed remains of three-gun emplacements and an observation tower that were formerly part of the Ringbrough WWII Battery (see **section 6.8** above, Hydrogen Storage Facility) are now located on the beach within the Marine Infrastructure Scoping Boundary with smaller structural elements and associated artefacts likely distributed throughout the intertidal zone.

7.7.3.7 In addition to the known sites described above, due to the area's historic role in fishing, navigation and defence, there is potential for additional, currently unknown, archaeological assets to be identified.

[105] Ford, Gregory (2021) The Victorian shipwreck you can see every day as the tide goes out. Available at: https://www.hulldailymail.co.uk/news/history/victorian-shipwreck-you-can-see-5475979 Accessed on: 19/08/2022

[106] Cohen et. al. (2017) The North Sea. In Submerged Landscapes of the European Contentental Shelf: Quaternary Paleoevironments. Editors Nicholas Flemming, Jan Harff, Delminda Moura, Anthony Burgess and Geoffrey N. Bailey. Wiley Blackwell.

Gaffney, V. Thomson K. and Fitch S. (2007) Mapping Doggerland: The Mesolithic Landscapes of the Southern North Sea. Archeopress: Oxford.

Key Sensitivities

7.7.3.8 Cultural heritage assets most vulnerable to impacts from the Marine infrastructure are as follows:

- shipwrecks / aircraft wrecks;
- intertidal WWII remains;
- palaeoenvironmental remains;
- other, as yet unknown, offshore cultural heritage; and
- other, as yet unknown, intertidal cultural heritage.

7.7.3.9 It is important to also note that the near shore seabed within the Scoping Boundary is also relatively shallow and means that heritage assets located there such as the Earl of Beaconsfield shipwreck, and any as yet unidentified assets, are at greater risk from deterioration. These assets may as a result be more sensitive to any additional effects introduced by the Proposed Development than those lying in deeper water parts of the Study Area further out to sea

7.7.4 Project Basis for Scoping Assessment

7.7.4.1 The construction, operation and decommissioning of marine infrastructure is likely to introduce new and different effects on the marine historic environment through direct and indirect impacts. In marine historic environment terms, a direct impact refers to any material alteration of a heritage asset resulting directly from project activity. Direct impacts are most likely to occur during excavation or other physical alteration of any previously undisturbed portions of seabed. Physical impacts on the seabed are most likely to occur during the upgrade of existing infrastructure or the proposed construction of a cofferdam on the beach, which are likely to remove any archaeological deposits they encounter.

7.7.4.2 An indirect impact refers to any change in the baseline condition of a heritage asset resulting from a development beyond the Proposed Development boundaries. Activities likely to have an indirect impact on the setting of marine heritage assets beyond the boundary include the construction of the cofferdam on the beach, which may temporarily affect the settings of onshore and marine/nearshore cultural heritage assets. These activities may also stir up sediments and in the process affect the preservation of shipwrecks in the vicinity.

7.7.5 Mitigation

7.7.5.1 Following guidance provided by Historic England[107] and the UK Marine Policy Statement,[108] impacts on marine and intertidal cultural heritage should be avoided in the first instance. If avoidance is not proportionate or possible, then recording and investigations to capture evidence from the historic environment should be conducted, and the information gathered made available to the public.

7.7.6 Likely Significant Effects to be Considered in the EIA

7.7.6.1 Table 7.15 provides a high-level assessment of the effects on marine archaeology at the scoping stage of the EIA process. The assessment is based on the envelope defined in the **Chapter 2 Proposed Development Description,** embedded mitigation measures if

[107] Historic England (2015) Assessing England's Protected Wreck Sites: https://historicengland.org.uk/images-books/publications/accessing-englands-protected-wreck-sites-guidance-notes/

[108] The UK Government. 2011. *UK Marine Policy Statement.* The UK Government: Westminster: 10164_Marine Statement_Cov.indd (publishing.service.gov.uk)

applicable, the evidence for potential effects, relevant policy, the assessment criteria provided in **Chapter 5 EIA Methodology** and the professional judgement of qualified marine archaeologists.

7.7.6.2 Table 7.15 sets out a high-level assessment of all the potential significant effects and defines which are to be scoped into the EIA. Construction and operational effects are outlined in Table 7.15; however decommissioning effects are anticipated to be no worse than construction effects and will be accordingly assessed where necessary and to the extent it is practicable to do so at the EIA stage in the absence of a decommissioning plan. Any decommissioning works will be subject at the time to its own assessment and Marine Licence application.

Table 7.15: Likely Effects - Marine Archaeology

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Seabed Disturbance	▪ Investigation and survey to develop a robust marine archaeology baseline considered for impact assessment ▪ Input to design process to maximise the avoidance of known features. ▪ Development of a Protocol for Archaeological Discovery (PAD).	High	Low to High	Minor to Major	Scoped In	DBA, geophysical and geoarchaeological survey and analysis
Sediment Kick-up/ Suspended Sediment	▪ Investigation and survey to develop a robust marine archaeology baseline considered for impact assessment ▪ Input to design process to maximise the avoidance of known features. ▪ Development of a PAD.	Medium	Medium	Moderate	Scoped In	DBA, geophysical and geoarchaeological survey and analysis. May require additional specialised baseline assessment of shipwrecks.
Intertidal ground disturbance	▪ Investigation and survey to develop a robust marine archaeology baseline considered for impact assessment ▪ Input to design process to maximise the avoidance of known features. ▪ Development of a PAD.	High	Medium	Moderate	Scoped In	DBA, geophysical and geoarchaeological survey and analysis.
Setting Impacts	Investigation and survey to develop a robust marine archaeology baseline considered for impact assessment.	Medium	Medium	Moderate	Scoped In	Setting Assessment

7.7.7 Effects Scoped out of the EIA

7.7.7.1 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).

7.7.7.2 Cultural heritage investigations in the marine and intertidal zones are not scoped out of the EIA as there are likely to be interactions between the marine infrastructure and cultural heritage assets in the area.

7.7.8 Proposed Approach to the Assessment

Baseline

7.7.8.2 As offshore construction elements are included in the current scheme of works, such as the construction of a cofferdam on the beach, intertidal and marine cultural heritage baseline data gathering will be required. As with the Hydrogen Storage Facility (see **Section 6.9**), this will involve a multi-staged and iterative process, including a DBA, followed by a phase of geophysical (raw multibeam, sidescan sonar, magnetometry and sub-bottom seismic data) and, if considered appropriate, geoarchaeological investigation.

7.7.8.3 The DBA aims to:

- identify all known cultural heritage assets that may be affected by the offshore Proposed Development including seabed prehistory, maritime archaeology, aviation archaeology, the historic seascape, buried archaeological remains and palaeoenvironmental records within the intertidal zone;
- identify areas of high archaeological potential; and
- identify the gaps in our baseline data and potential risks for the Proposed Development.

7.7.8.4 Marine and intertidal cultural heritage DBA consists of elements of research and consultation that are typically summarised in a standalone report for inclusion in planning submissions.

- Informed by the DBA, a walkover survey of the intertidal zone impacted by the Marine Infrastructure will be undertaken at low tide. Walkover surveys will be scheduled to overlap with the DBA research, so they can both inform one another.

7.7.8.5 Walkover surveys are conducted to:

- confirm any cultural heritage receptors identified in the DBA;
- identify any further sites, not identified in the DBA but visible on the surface; and
- undertake assessments of archaeological visibility and potential.

7.7.8.6 The third stage of data gathering will consist of specialist marine and intertidal geophysical and geoarchaeological investigations. The extent of this third stage will depend on the level of nearshore and offshore construction. It is also likely that some geophysical and sedimentary survey (such as vibrocores) would be conducted for engineering purposes, which may mean that full baseline geophysical survey for cultural heritage purposes will not be required. In this case, the raw data will still need to be approved beforehand and analysed by marine archaeologists and a programme of more targeted geophysical survey for archaeological purposes designed if appropriate. In addition to data gathering at this third stage, a PAD must be developed to establish the roles and next steps in the event of an unanticipated archaeological discovery.

Assessment Criteria

7.7.8.7 The assessment criteria for the historic environment of the Marine Infrastructure will be the same as that outlined in **Section 6.9.8**.

7.8 Commercial Fisheries

7.8.1 Introduction

7.8.1.1 This section of the Scoping Report identifies the commercial fisheries receptors of relevance to the Proposed Development and considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore and shoreline components (i.e. temporary cofferdam) on commercial fisheries. The North Sea is an important area for populations of several commercially exploited fish and shellfish species.

7.8.2 Topic-specific Regulatory Requirements and Guidance

7.8.2.1 The topic-specific regulatory requirements and guidance is the same as those used for the assessment in **Section 7.3**.

7.8.3 Baseline Environment

Data Sources used in Scoping

7.8.3.1 A number of commercial fisheries datasets have been collated as well as a desktop review of publicly available data undertaken to inform this Scoping Report. Baseline information was drawn from the study carried out by the Institute of Estuarine and Coastal Studies during November 2003 (IECS, 2004) along with an assessment of potential environmental impacts from coastal works during construction and operation carried out in August 2022 by the University of Hull (IECS, 2022). This also includes studies by Ellis et al. (2012), Coull et al. (1998) and a detailed characterisation of the fish and shellfish communities within the nearby Hornsea Zone. This included the array area and the wider southern North Sea fish and shellfish study area of the ES for Hornsea Project Three (Orsted, 2018).

Description

7.8.3.2 There are several fishing ports along the region's coastal fringe which use a variety of different methods depending on the type of species sought. The coastal region from Bridlington to Spurn Head, located north and south-east of Aldbrough respectively, are of local commercial importance being largely fished by small boats and a substantial number of shore-based recreational angling.

7.8.3.3 The species available to the local inshore fleet may be classified into five main categories.

- demersal species – near-bottom fish such as cod rays (spp.), sole, European bass (*Dicentrarchus labrax*), whiting and plaice.
- pelagic species – mid-water shoals of fish such as herring mackerel European bass and sprat.
- migratory species – inshore salmonids such as Atlantic salmon, sea trout bass (spp.).
- recreational and sport fisheries – including other fishes such as sharks.
- shellfish species – bottom-dwelling invertebrate species such as crabs, lobsters and whelks.

Table 7.16: Coverage of the Proposed Development in Relation to Commercial Fisheries

Source	Summary	Coverage of the Proposed Development
Landing statistics, for the five-year period 2012-2016. Sourced from the MMO and the European Union Data Collection Framework (EU DCF).	Fisheries landings data for nationally registered fishing vessels landing to their home nation ports.	Full coverage of the Proposed Development.
Vessel Monitoring System (VMS) data, for the five-year period 2012 – 2016. Sourced from the MMO.	Fisheries effort and landings data for fishing vessels greater than 15 m in length.	Full coverage of the Proposed Development.

7.8.3.4 Commercial use of the area is limited to commercial fishing. Whilst this is predominantly restricted to the utilisation of fishing vessels targeting crustacean stocks, there is some limited intertidal netting for sea bass based onshore. The Eastern Inshore Fisheries and Conservation Authority (IFCA) implemented a dedicated byelaw in 2019 (Fish, Mollusc and Crustacea Minimum Size Emergency Byelaw 2019, Schedule III) to protect developing inshore bass *(Dicentrarchus labrax*) stocks from overexploitation through the management of intertidal or near-shore netting effort. The byelaw also protects salmon and migratory trout, by prohibiting fishing with nets at times and in places where these species are vulnerable to capture with enmeshing nets (IFCA, 2020). The period allowed for is 15th October to 30th April inclusive with other conditions (IFCA, 2020). Therefore, shore-based effort concentrated within the Proposed Development, is negligible due to the byelaw in place.

7.8.3.5 Below the mean spring low water mark the commercial fishery is dominated by crab and lobster potting. Due to the restriction of the inshore fleet in terms of vessel size, which is dictated by launching capability, the nearshore coastal margins are of significant importance. Vessels from Withernsea, Tunstall, Hornsea and Bridlington target edible crab, lobster and velvet swimming crabs throughout the year. Depending on the season, fishers lay pots inshore for lobsters moving farther offshore as the species migrates to deeper water. Edible crab make up a major part of the catch throughout the year, although the lobster catch is considered of equal importance economically (IECS, 2022).

7.8.3.6 Some limited static nets are placed inshore at certain times of the year to coincide with specific species migratory movements (bass, cod, sole and rays); however, the level of effort is dictated by the state of available stocks (IECS, 2022). There is little or no apparent other commercial fishery use of the inshore waters within or immediately adjacent to the Proposed Development.

7.8.3.7 In the context of fin-fish, there is a seasonal fishery along the Holderness Coast. Cod is fished during the winter months (October-December), using static nets by several beach-launched vessels mainly from Hornsea, Withernsea, Tunstall and Bridlington. Current stock levels indicate the species is in decline in this region of the North Sea (IECS, 2022). A few larger vessels, based at Scarborough and Grimsby, target cod using otter trawls along the Holderness coast during winter months. However, due to the implementation of new trawling restrictions, trawling cannot occur within the three-mile limit (Withernsea to Spurn Lighthouse). During spring and early summer, fishers concentrate their efforts on the thornback ray and dover sole. Between the 26th March and the 31st of October netting for Dover sole and other fin fish species inside the 10 metre depth contour is not permitted, under IFCA by-laws (XVIII. Fixed Engine (Authorisation) Byelaw) (IFCA, 2020).

Key Sensitivities

7.8.3.8 The key fishing activities operating in the area of the Proposed Development (i.e. within the Scoping Boundary and nearby parts of the Holderness inshore area) are:

- mainly locally-based potters targeting brown crab, lobster and whelk (vessels typically 15 m and under in length, but possibly including over 15 m vessels), operating across the offshore ECC and southern portion of the Proposed Development; and
- locally-based static net fishing.

7.8.4 Project Basis for Scoping Assessment

7.8.4.1 The main basis of assessment for construction impacts is the maximum case:

- construction of a nearshore cofferdam, potentially involving steel sheet piling, and its removal at the end of construction;
- laying of new pipelines from the cofferdam to abstraction point and diffuser;
- installation of a diffuser; and
- pre-construction surveys.

7.8.4.2 Effects on commercial fisheries will potentially occur as a result of:

- secondary effects on fishing due to construction and operational impacts (including entrainment at the intake discussed below) on fish and shellfish that are targeted commercially; and
- exclusion, interference and displacement of fishing activity.

7.8.4.3 The assessment of effects on fish and shellfish ecology will provide the basis for assessing the former.

7.8.4.4 Exclusion, interference and displacement of fishing activity will occur temporarily due to the footprint during construction, including any safety zones and access zones required for vessels and installation activity.

7.8.4.5 Longer term exclusion, interference and displacement of fishing activity during operation is likely to be limited to a very small zone around the diffuser and infrequently during any required maintenance works.

Seawater Abstraction and Brine Discharge

7.8.4.6 It is expected that the abstraction of seawater and discharge of brine will have effects on the surrounding environment, although with appropriate integrated control and mitigation measures, these can be minimised. As the design of the intake will be above the seabed and wide enough to optimise intake velocities for the planned take volumes, impacts on fish, shellfish and invertebrates will be reduced. Most fish will be able to swim away from the intake as part of natural avoidance behaviour, and shellfish should not encounter any notable alteration in current velocities on the seabed. Brine discharges will be similar in composition and volume flow rate to the AGS discharge. Based on the monitoring data for the AGS brine discharge, impacts are predicted to be localised and unlikely to have significant effects on fish, shellfish and benthos.

7.8.4.7 However, mortality of planktonic organisms is unavoidable given the requirements of the development. It is considered that the operation will not have a measurable impact on the ecological value of the coastline within and in the vicinity of the development. Localised impacts on some species, and hence to the commercial fishing of some of those species, are possible although data is not currently available to fully quantify the extent of this issue.

It is therefore considered that although no long-term or irreversible effects on the biota of the area would be expected from the operation of the Proposed Development, the potential exists for some short-term variation specifically to the shellfishery of the area. Therefore, it is recommended that the abstraction of this volume of water and relevant organisms affected should be assessed within the context of the wider area.

7.8.4.8 Given the importance of local inshore waters to the region's commercial fishing fleet, effort will be made to characterise the available commercial resource across the Proposed Development. A baseline survey of the existing shellfishery stock, coupled with ongoing surveys throughout the discharge period, are proposed to monitor for any possible impact.

7.8.5 Mitigation

7.8.5.1 The mitigation measures that will be applied will typically include but not necessarily be limited to the following:

- notification of all works and the location for works to local fishers at a suitable time in advance of any works taking place;
- formally liaising with fishers over fixed gear deployment so that fishing effort can be maximised without risk to fishers or risk of damage to fixed and mobile gear;
- where there is flexibility in the timing of works, to programme such works in a way that seeks to minimise interruption of fishing effort;
- setting up and maintaining good communication channels to facilitate the delivery of the mitigation measures; and
- minimising entrainment of fish and shellfish from abstraction with appropriate integrated control and mitigation measures of seawater abstraction rates and design of seawater intake.

7.8.6 Likely Significant Effects to be Considered in the EIA

7.8.6.1 Potential issues relating to the proposed development on commercial fisheries centre around the disturbance of commercial fishing operations during the construction phase and potential impacts on fish and shellfish during the operational phase. The brine discharge during operation may affect the biota of the area around the monopile (discussed in Benthic and Intertidal Ecology and Fish and Shellfish sections). Therefore, it is anticipated that there will be an associated impact on species important to commercial fishing activity.

7.8.6.2 Table 7.17 provides a high-level assessment of the effects on commercial fisheries at the scoping stage of the EIA process. The assessment is based on the envelope defined in the **Chapter 2 Proposed Development Description**, embedded mitigation measures if applicable, the evidence for potential effects on marine mammals, relevant policy, the assessment criteria provided in **Chapter 5 EIA Methodology** and professional judgement.

7.8.6.3 Table 7.17 sets out a high-level assessment of all the potential significant effects and defines which are to be scoped into the EIA. Construction and operational effects are outlined in Table 7.17; however decommissioning effects are anticipated to be no worse than construction effects and will be accordingly assessed where necessary and to the extent it is practicable to do so at the EIA stage in the absence of a decommissioning plan. Any decommissioning works will be subject at the time to its own assessment and Marine Licence application.

Table 7.17: Likely Effects – Commercial Fisheries

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction: construction activities leading to displacement or disruption of commercially important fish or shellfish resources.	N/A	Small	Medium	Likely significant effect without secondary mitigation. Effect likely to be of minor significance, as it will be short-term and of a local extent.	Scoped In. A detailed assessment of baseline data analysis and consultation with national and international fleets to characterise commercial fisheries activity in the study area.	Gather up-to-date publicly available data and consultations with active fleets.
Construction: increased vessel traffic within wider fishing grounds as a result of displacement of fishing effort from Proposed Development area and construction activities leading to interference with fishing activity.	N/A	Fleet dependent; up to Small	Fleet dependent; up to Medium	Likely significant effect without secondary mitigation. Effect likely to be of minor significance at most, depending on fleet assessed. There is potential for displacement of fishing activity, although they will be short-term and of a local extent. The operational range of fleets is typically not limited to the area.	Scoped In. A detailed assessment of baseline data analysis and consultation with national and international fleets to characterise commercial fisheries activity in the study area.	As above.
Operation: physical presence of Proposed Development leading to reduction in access to, or exclusion from established fishing grounds.	N/A	Negligible	Fleet dependent; up to Medium	Not significant as the AGS monopile is already present and part of the existing commercial fisheries baseline.	Scoped Out.	N/A
Operation and maintenance: activities leading to displacement or disruption of commercially important fish and shellfish resources.	N/A	Negligible	Medium	Not significant based on the small scale and infrequency of the activity.	Scoped Out.	N/A

7.8.7 Effects Scoped out of the EIA

7.8.7.1 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).

7.8.7.2 The physical presence of the Proposed Development during operation will not lead to a reduction in access to, or exclusion from, established fishing grounds largely because the AGS monopile is already present and part of the existing commercial fisheries baseline.

7.8.7.3 Operation and maintenance activities will not lead to displacement or disruption of commercially important fish and shellfish resources, since these will be small scale and infrequent. Therefore, it is proposed that commercial fisheries are scoped out of this assessment for operation and maintenance.

7.8.8 Proposed Approach to Assessment

7.8.8.1 Analysis of existing baseline datasets (see **Section 7.8.3.1**) will be undertaken to characterise long-term patterns in commercial fisheries activity across the commercial fisheries study area. This will predict the potential impacts upon future commercial fishing activities. For vessels less than 15 m in length, existing aerial surveillance data and monthly shellfish activity returns will provide an insight to fisheries activity. Consultation with the commercial fishing industry, especially locally-based fishers, will be undertaken to ground-truth available baseline data and gain further understanding of the fishing activity by smaller vessels. Consultation will focus on providing a more detailed understanding of the Proposed Development activities, how then may affect fishing activity and the development of suitable agreed mitigation measures.

7.8.8.2 An analysis of data sources available will inform an extended baseline characterisation of the commercial fisheries study area. This, together with industry consultation, will underpin the impact assessment for each of the scoped in effects. Additional datasets including maps of key fishing grounds may also be available.

7.9 Seascape and Visual Resources

7.9.1 Introduction

7.9.1.1 This section of the Scoping Report identifies the offshore seascape and visual receptors of relevance to the Proposed Development and considers the potential effects from construction and operation (including maintenance) of the offshore and shoreline components of the Proposed Development on seascape and visual resources (SVR).

7.9.2 Topic-specific Regulatory Requirements and Guidance

7.9.2.1 The methodology for the assessment of SVR is based on current best practice guidance, namely:

- Landscape Institute/ Institute of Environmental Management and Assessment (2013), GLVIA;
- Landscape Institute (2013), GLVIA3 Statement of Clarification 1/13;
- Landscape Institute (2019), ‘Visual Representation of Development Proposals’, Technical Guidance Note;
- Landscape Institute (2021), Technical Guidance Note 02/21 Assessing landscape value outside national designations;

- Natural England and DEFRA (2014) Landscape and Seascape Character Assessments; and
- Natural England (2014) An Approach to Landscape Character Assessment.

7.9.3 Baseline Environment

Data Sources used in Scoping

7.9.3.1 A baseline condition will be established using a desktop study, which reviews and applies the publicly available primary data sources listed in Table 7.18**.** Marine and coastal structures which are already present in the study area of the SVR assessment (defined as 2.5km radius around permanent above ground infrastructure, and 1km radius around buried infrastructure and temporary works) will be identified and listed in order to characterise the nature of the coastline. This will include the monopile which houses brine pumping equipment from previous salt cavern excavations.

Table 7.18: Key Sources of Infrastructure and Other Users Data

Source	Summary	Coverage
SeaZone Hydro View 1:75,000 raster and vector mapping.	Base mapping and information for sea area.	Full coverage of the Proposed Development SVR study area.
MPAs (MMO, 2014).	Provides mapping of MPAs in England.	Full coverage of the Proposed Development SVR study area.
Seascape characterisation around the English Coast (MPAs 3 and 4) (Natural England, 2012).	Pilot study that describes and defines areas based on their seascape characteristics at a national scale. Perceptual qualities information included.	Full coverage of the Proposed Development SVR study area.
Seascape character area assessment for East Inshore and East Offshore MPAs (MMO, 2012).	Describes and defines areas based on their seascape characteristics at a national scale.	Full coverage of the Proposed Development SVR study area.
MMO1134 Seascape Character Assessment for the North East Inshore and Offshore MPAs (MMO, September 2018).	Describes and defines areas based on their seascape characteristics at a national scale.	Full coverage of the Proposed Development SVR study area.
Historic Seascape Characterisation (HSC): Consolidating the National HSC Database. (Land Use Consultants (LUC), 2017).	Provides mapping and descriptions of the HSC types and sub-types across four sea levels.	Full coverage of the Proposed Development SVR study area.
UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4).	SEA for further coastal and offshore development in the UK Exclusive Economic Zone and territorial waters.	Full coverage of the Proposed Development SVR study area.

Description

National Seascape Character Areas (NSCAs)

7.9.3.2 The likely effects of the Proposed Development on existing SVR are considered for this scoping report. The study area for the SVR assessment is located within the MPA East Inshore (MPA 3). This area is further subdivided into NSCA 5: Holderness Coastal Waters, as described below in Table 7.19.

Table 7.19: Baseline character of the NSCA within the SVR assessment study areas

NSCA	Baseline Characteristics	Change in Character
NSCA 5: Holderness Coastal Waters	■ Expansive, sweeping coastline undergoing dynamic natural coastal processes of erosion. ■ Extensive soft glacial till cliffs. ■ Heritage Coasts of Flamborough Head and Spurn Head to the northern and southern extents. ■ Open, exposed character by merit of low-lying coastal topography and an absence of vegetation. ■ Large and featureless seaward horizon. ■ Flat topography results in the views of the seascape from land being generally restricted to coastal towns and immediate cliff edges. ■ Heavily potted coastal waters with strong fishing heritage. ■ Generally shallow waters which preclude commercial shipping. ■ Submerged gas pipelines and Easington Gas terminal. ■ Military practice area. ■ Extensive WW1 and WW2 coastal defenses, subject to coastal erosion. ■ Variety of roosting and feeding seabirds dispersing from nesting areas.	The Westermost Rough and Humber Gateway offshore wind farms are located within the southern part of this NSCA and have altered its character (since the Seascape character area assessment for East Inshore and East Offshore MPAs (MMO, 2012) was undertaken) through physical and visual changes to it through the introduction of large scale, moving structures.

Landscape / Seascape Planning Designations and Defined Areas

7.9.3.3 The visual characteristics of the SVR study area looking seawards can be described as relatively homogenous. From the coastline, views consist mostly of the shoreline and sea views with a number of wind turbines visible during clear days. The coastline itself is sweeping and expansive, with soft glacial till cliffs. It experiences dynamic natural processes of erosion and exhibits an open, exposed character with a low-lying coastal topography and little present coastal vegetation that could impact sea views, thus providing views to a large seaward horizon. The coast is dotted with extensive WW1 and WW2 coastal defences subject to erosion. Due to the flat topography of the coastline, views inland are mostly limited to cliffs and occasional coastal towns.

7.9.3.4 There are no statutory landscape designations (National Parks or AONBs) within the study area of the SVR assessment.

7.9.3.5 Heritage Coasts are protected through development control within the planning system. These were established to conserve the best stretches of undeveloped coast in England. A Heritage Coast is defined by agreement between the relevant maritime local authorities and

Natural England. Paragraph 178 of the NPPF (2021) states that 'major development within a Heritage Coast is unlikely to be appropriate unless it is compatible with its special character'.' Located approximately 28km north of the Proposed Development, land at Flamborough Head is defined as a Heritage Coast. However, given its distance from Flamborough Head, it is not considered likely that the Proposed Development will result in any visual impacts on receptors at the Heritage Coast.

7.9.3.6 With the exception of the non-statutory Heritage Coast designation at Flamborough Headland, there are no landscape / seascape designations located within the boundary of the SVR study area.

Visual Resources

7.9.3.7 Visual receptors within the SVR study area can be broadly defined as people that are undertaking recreational activities and those that are working. People undertaking recreational activities include those on yachts and other vessels who are doing so partly with the intention of enjoyment of their surroundings. The pattern of the Royal Yachting Association (RYA) cruising routes indicates that most journeys are close to the shore and thus are potentially afforded views to the temporary cofferdam planned for construction at the beach if movement takes place close to the shoreline. The character of the views from these locations will be defined both by the landscape of the coast and the open sea.

7.9.3.8 Other recreational receptors include boat users, passing from the shore to the open sea. This would be mostly the case for small vessels leaving Hull and traveling north along the shoreline. Fishing of many types also occurs in the SVR study area. The majority of the views obtained by these people are of the open sea with occasional glimpses of gas platforms, offshore wind farms (OWFs) or associated infrastructure and other vessels on the seaward side. The cofferdam and construction vessels at the shoreline are likely to be visible for coastal boat traffic during construction. Fishing of many types occurs extensively across the region.

7.9.3.9 In terrestrial areas, potential receptors include users of coastal roads and beaches for commuting or leisure (e.g. tourist activities, exercising, bird watching). Views would also be potentially afforded to the Proposed Development (including construction of the cofferdam) from residents of nearby settlements and residential areas. However, these views are likely to be limited due to the number of residential properties within close proximity. The village of East Newton is located 800 m north of the Proposed Development, with residential properties within Garton located approximately 700 m south. In addition, views from workers at AGS would potentially be available. As the final location of the temporary foreshore cofferdam is not yet established, there is uncertainty in the characteristics and number of receptors likely to be influenced.

7.9.3.10 The types of visual receptor likely to be present within the study area can therefore be described as follows:

- residents of nearby settlements / residential areas;
- sailors following the cruising routes identified by the RYA, which are largely located close to the coast, and individually organised small cruise vessels traveling along the coast;
- people at their place of work on commercial fishing vessels;
- tourists and people undertaking leisure activities along the coastline;
- commuters using coastal and backcountry roads; and
- workers at AGS.

Key Sensitivities

7.9.3.11 The effects on existing seascape character will occur in close proximity to the Proposed Development itself, located within NSCA 5: Holderness Coastal Waters. . The area is characterised by maritime activities / receptors, albeit with only a limited number of receptors along the coast itself.

7.9.3.12 The main changes introduced due to the construction and operation of the Proposed Development will be a temporarily impacted view of the coastline, from the seaward side as well from the landward side.

7.9.3.13 It is assessed from a review of the baseline visual receptors that local residents, as well as the people in vessels for the purpose of recreation, are likely to be the most sensitive to the temporary changes in their views which would occur as a result of the Proposed Development.

7.9.4 Project Basis for Scoping Assessment

7.9.4.1 To consider the likelihood for significant effects to arise on the seascape and visual receptors described above a preliminary worst-case scenario has been developed to inform this SVR assessment.

7.9.4.2 At this early stage in the EIA process, the items identified with the potential to influence seascape and visual resources are limited to temporary infrastructure.

7.9.4.3 Temporary infrastructure during construction will include the following:

- A cofferdam which will be constructed on the beach at the base of a cliff, made up of steel sheet piles on all four sides.
- Offshore pipelines and a sub-surface diffuser will be installed and this will involve various marine construction vessels being present.

7.9.4.4 There will be no permanent infrastructure protruding above the beach or sea level.

7.9.5 Mitigation

7.9.5.1 Given the transitory nature of the majority of the visual receptors, no additional measures are proposed specifically in relation to the location or arrangement of the cofferdam. Therefore, no mitigation measures are proposed in relation to maintaining seascape character.

7.9.6 Likely Significant Effects to be Considered in the EIA

7.9.6.1 Table 7.20 provides a high-level assessment of the effects on SVR at the scoping stage of the EIA process. The assessment is based on the envelope defined in the **Chapter 2 Proposed Development Description**, embedded mitigation measures (if applicable), the evidence for potential effects on SVR, relevant policy, the assessment criteria provided in **Chapter 5 EIA Methodology** and professional judgement.

7.9.6.2 A high-level assessment of all the potential significant effects, including those to be scoped into the EIA, is provided. Construction and operational effects are also outlined in Table 7.20. Decommissioning effects are anticipated to be no worse than construction effects and will be accordingly assessed where necessary and to the extent it is practicable to do so at the EIA stage in the absence of a decommissioning plan. Any decommissioning works will be subject at the time to its own assessment and Marine Licence application.

Table 7.20: Likely Effects - SVR

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment (Scoped Out, Scoped In)	Further Baseline Data Requirements
Construction Activities visible day and night from beach and offshore	None	Small	Generally low; medium sensitivity for nearby residential areas, sea surface leisure activities (e.g. sailing) and leisure activities with direct view of cofferdam construction.	Construction noise impacts for nearby residential areas and leisure activity.	Scoped In	Detailed location of construction site for cofferdam required to evaluate on-site vicinity.
Construction Activities visible day and night from onshore	None	Small	Low: cofferdam is at base of cliff so will not be visible from visual receptors set back from coast.	No likely significant effects	Scoped Out	None
Operational Phase: AGS offshore monopile visible by day and night from onshore and offshore visual receptors	None	Negligible	Low	Under the reuse option, alterations to the existing monopile will not materially change its existing visual character	Scoped Out	None

7.9.7 Effects Scoped Out of the EIA

7.9.7.1 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).

7.9.7.2 The effects which have been scoped out of the EIA process are impacts due to construction activities (i.e. temporary cofferdam) on onshore visual receptors as the location of the activity will ensure it is not visible to onshore receptors.

7.9.7.3 There will be no operational effects since the only feature above sea or beach level will be the existing monopile. While there is a scenario where it may have some refurbishment works these would not materially change its visual character.

7.9.8 Proposed Approach to the Assessment

7.9.8.1 The visual receptors within the study area of the SVR assessment are transitory in nature, and the impacts being considered are temporary in nature. Once detailed location information on the location of the construction areas is available, consideration will be given to the need for a separate seascape, landscape and visual impact assessment (SLVIA) Chapter, since SLVIA receptors could be addressed within the LVIA Chapter.

7.9.8.2 Should separate chapters be required, the SLVIA Chapter will present a simple assessment of the temporary effects on the identified receptors, following the methodology presented in the LVIA section of this Scoping Report. The SLVIA will be undertaken with reference to the LVIA viewpoints and photography. No SLVIA specific viewpoints or photography are proposed.

7.10 Infrastructure and Other Users

7.10.1 Introduction

7.10.1.1 This section of the Scoping Report identifies the infrastructure and other marine user receptors of relevance to the Proposed Development and considers the potential effects from construction of the offshore and shoreline components (i.e. temporary cofferdam) on infrastructure and other marine users. Operation of the Proposed Development has no scope for effects on the infrastructure and other users considered in this section and therefore does not need to be addressed. Shipping and Navigation are addressed in **Section 7.11** and Commercial Fisheries in **Section 7.8**.

7.10.1.2 The following infrastructure and other marine user receptors will be considered:

- OWFs;
- existing and proposed cables and pipelines;
- CCS and natural gas storage;
- disposal sites;
- the Ministry of Defence (MoD) Practice and Exercise Areas (PEXAs);
- aggregate extraction; and
- oil and gas operations.

7.10.2 Baseline Environment

Data Sources used in Scoping

7.10.2.1 The data sources used for assessment are described below in Table 7.21.

Table 7.21: Key Sources of Infrastructure and Other Users Data

Source	Summary	Coverage
The Crown Estate (TCE) Charts Offshore Wind Lease Agreement Areas	Offshore wind farms	Full coverage of the Proposed Development
OceanWise Marine Themes Kingfisher Information Service – Cable Awareness (KIS-ORCA) UK Oil and Gas Data	Offshore cables and pipelines	Full coverage of the Proposed Development
OceanWise Marine Themes TCE	Disposal Sites	Full coverage of the Proposed Development
TCE Aggregate Licence Area Charts	Marine aggregate extraction	Full coverage of the Proposed Development
TCE	CCS	Full coverage of the Proposed Development
TCE	Natural gas storage	Full coverage of the Proposed Development
DESNZ UK Oil and Gas Data	Oil and gas infrastructure	Full coverage of the Proposed Development
OceanWise Marine Themes	PEXAs	Full coverage of the Proposed Development

Description

Offshore Wind Farms (OWFs)

7.10.2.2 The nearest OWF is the Westermost Rough OWF with an approximately 210 MW installed capacity, located approximately 23 km to the east of the Proposed Development area.

Existing and Proposed Cables and Pipelines

7.10.2.3 The nearest subsea cable is the Westermost Rough offshore transmission asset which connects the Westermost Rough OWF with the mainland grid with a length of 14 km at 15 kV.

CCS and Natural Gas Storage

7.10.2.4 There are currently no CCS or natural gas storage sites located within the study area.

Disposal Sites

7.10.2.5 There are currently no disposal sites located within the Proposed Development.

MoD PEXAs

7.10.2.6 A PEXA is a designated offshore area which can be used by the Army, Air Force or Navy for firing practice and exercises. The MoD uses all uncontrolled UK airspace above Flight Level (FL) 195 (19,500 feet) for Army, Air Force and Navy training. There are currently no PEXAs within the vicinity of the study area and the area lies within uncontrolled airspace.

Aggregate Extraction Sites

7.10.2.7 There are currently no licensed aggregate extraction sites within the study area.

Oil and Gas Operations

7.10.2.8 Licenses for the exploration and extraction of oil and gas on the UK Continental Shelf have been offered since 1964 and are granted by the Oil and Gas Authority (OGA). These licences are granted for identified geographical UKHO areas (blocks and sub-blocks) in consecutive rounds, with the most recent being the 32nd licensing round launched in July 2019.

7.10.2.9 The main type of offshore licence is the Seaward Production Licence. This may cover the whole, or part of a specified block or a group of blocks, and grants exclusive rights to the holders 'to search and bore for, and extract petroleum' (including gas) in the area covered by the licence. The traditional licence (the most common type of Seaward Production Licence, has an initial term of four years, though can be renewed for a further four years with a third term of 18 years. Longer terms may apply in certain areas. Exclusive rights may also include retained rights within an existing licenced acreage.

7.10.2.10 There are currently no areas with applicable oil and gas licenses adjacent to the study area. Additionally, there are currently no subsurface structures or pipelines in the vicinity. The only structure in the vicinity is the decommissioned monopile in place for AGS.

7.10.3 Likely Significant Effects to be Considered

7.10.3.1 There is no other infrastructure or use of the area by other sea users that could be affected by the Proposed Development. It is therefore proposed that effects on the other infrastructure and sea users considered in this section of the Scoping Report are scoped out of the EIA.

7.10.3.2 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).

7.10.4 Proposed Approach to the Assessment

7.10.4.1 A desk study will be conducted, supported by consultation with relevant stakeholders and operators, to establish the relevant status of the known and foreseeable offshore infrastructure and other marine user activity present or that may occur within the vicinity of the Proposed Development to confirm, or otherwise, that an assessment of likely significant effects is not required.

7.10.4.2 Planned and consented activity, not yet under construction, but which could be present in advance of the Proposed Development, will be identified and effects on it suitably assessed (as well as for cumulative effects with the Proposed Development).

7.11 Shipping and Navigation

7.11.1 Introduction

7.11.1.1 This section of the Scoping Report identifies shipping and navigation receptors of relevance to the Proposed Development. It considers the potential effects from construction, operation (including maintenance) and decommissioning of the offshore components of the Proposed Development on shipping and navigation.

7.11.2 Topic-specific Regulatory Requirements and Guidance

7.11.2.1 As the Proposed Development will only have the potential to disrupt shipping during the construction phase and only potentially have the diffuser marked by a navigation buoy, it will be necessary to issue a Notice to Mariners via the Royal Yachting Association (RYA) during construction works and ensure Admiralty charts are updated with any buoy locations.

7.11.3 Baseline Conditions

Data Sources Used in Scoping

7.11.3.1 The following data sources were used to support this Scoping Report. The data sources listed and summarised below cover the AHS offshore area:

- Hornsea Project Four: ES;
- Automatic Identification System (AIS) data;
- incident data provided by the Marine Accident Investigation Branch (MAIB);
- VMS data; and
- Royal Yachting Association (RYA) data.

Description

7.11.3.2 During the winter months vessel traffic is mainly made up of vessels fishing (usually potting) or in transit to fishing grounds. In the summer the number of vessels passing through the area increases substantially, especially at weekends, with more leisure activity. The majority of vessels tend to stay at least 1.5 km from the coast. There is very little merchant traffic through the Scoping Boundary and nearby for two main reasons.

- Firstly, the main navigational route to and from the Humber is further offshore from a position to the east of Flamborough Head to the Humber Light-buoy.
- The second factor is the high density of static fish gear that is located in the area.

7.11.3.3 The River Humber is the busiest estuary in the UK; however, the nearest part of the Proposed Development is located approximately 22 km outside the Humber Port limits. The main navigational feature in the vicinity of the Proposed Development is the Humber Traffic Separation Scheme (TSS), an internationally recognised routing measure established by the International Maritime Organisation (IMO) in 2001, with the aim of separating opposing streams of shipping traffic and reducing the likelihood of ship-to-ship encounters and hence collisions. The TSS is approximately 30 km away from the Proposed Development.

Key Sensitivities

7.11.3.4 No navigational features, including formal shipping lanes, will be affected by the Proposed Development.

7.11.3.5 The main other vessel activity in the areas affected by the Proposed Development is associated with the movement of commercial fishing vessels to and from their fishing areas and vessels involved in leisure activity. The potential effects of disruption commercial fishing activities are addressed in **Section 7.8**.

7.11.4 Project Basis for Scoping Assessment

7.11.4.1 The main aspect of the Proposed Development that have the potential to affect other vessels using the area will be a temporary safety exclusion zone around the construction works. Vessels will not be allowed to enter or pass through this area for safety reasons. It is yet to be determined if there will also be a defined access corridor of shore to the works. If so, vessels will be able to pass through this area in accordance with standard navigational practices for passing near other vessel and such practices will also be observed by the vessels of the Proposed Development. Several different types of vessels and construction equipment will need to be mobilised to and from the works.

7.11.5 Mitigation

7.11.5.1 The main mitigation measures will include but not be limited to the following:

- Notices to Mariners regarding temporary construction works;
- the pipeline will be buried and present no obstacle to navigation and present no snagging risks to anchors or fishing gear;
- a temporary exclusion zone around the works during construction for the safety of Proposed Development and third-party vessels;
- a defined construction vessel access corridor from shore to the works area; and
- appointment of a Fisheries Liaison Representative (or similar, see also **Section 7.8**).

7.11.6 Likely Significant Effects to be Considered in the EIA

7.11.6.1 Table 7.22 provides a high-level assessment of the effects on marine navigation at the scoping stage of the EIA process. The assessment is based on the envelope defined in the **Chapter 2 Proposed Development Description**, embedded mitigation measures if applicable, the evidence for potential effects on marine mammals, relevant policy, the assessment criteria provided in **Chapter 5 EIA Methodology** and professional judgement.

7.11.6.2 Table 7.22 sets out a high-level assessment of all the potential significant effects and defines which are to be scoped into the EIA. Construction and operational effects are outlined in Table 7.22; however decommissioning effects are anticipated to be no worse than construction effects and will be accordingly assessed where necessary and to the extent it is practicable to do so at the EIA stage in the absence of a decommissioning plan. Any decommissioning works will be subject at the time to its own assessment and Marine Licence application.

Table 7.22: Likely Effects – Shipping and Navigation

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment Scoped Out, Scoped In	Further Baseline Data Requirements
Construction / Decommissioning phases: Increased collision risk – movement and presence of construction vessels increases the risk of collision with third party vessels	Defined access corridor; safety exclusion zones; Notices to Mariners	Negligible to Small	Medium	Minor Significance	Scoped In	Further baseline data will be acquired to confirm the low level of usage of the proposed Development area by non-fishing vessels
Construction / Decommissioning phases: Impact on third party vessel (fishing, recreational and commercial) routeing – safety exclusion zone causes deviations in vessel routes, increasing transit time	As above	Negligible	Medium	Not Significant	Scoped Out	None
Construction / Decommissioning phases: Obstruction to emergency search and rescue (SAR) activities	Notices to Mariners	Negligible	Medium	Not Significant (the presence of construction vessels would enhance local SAR capacity)	Scoped Out	None
Construction / Decommissioning phases: Impact on fishing activity – construction activities	Construction monitoring and coordination for project vessels and notice to mariners	Small	Low	Not Significant	Scoped Out	None

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Sensitivity	Likely Significance of Effect	Proposed Approach to Assessment Scoped Out, Scoped In	Further Baseline Data Requirements
adversely affect the activities of fishing users						
Construction / Decommissioning phases: Anchor snagging risk – partially constructed pipeline is snagged by a vessel anchor	Safety exclusion zone; Notice to Mariners	Negligible	Medium	Not Significant	Scoped Out	None

7.11.7 Effects Scoped Out of the EIA

7.11.7.1 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).

Vessel to vessel collision risk

7.11.7.2 Increased vessel movements during both construction and decommissioning, as well as during operation if maintenance is required, could cause some vessels to deviate from usual routes. Deviation of vessels around the Proposed Development can lead to increased encounters and, consequently, increased vessel to vessel collision risk for all vessels in all weather conditions. As the scale of the Proposed Development is relatively small and construction and decommissioning phases are expected to be short term, the impact of construction and decommissioning operations is predicted to be low. For all vessel types, it is considered that there is no risk of likely significant effect, and it is proposed that this impact be scoped out of the EIA.

Anchor snagging

7.11.7.3 The offshore pipeline poses a risk of increased anchor snagging for all vessels associated with the Proposed Development. Suggested mitigation includes chartering the pipeline to reduce the likelihood of snagging during operation. Therefore, it is proposed that this impact be scoped out of the EIA.

Restricted emergency response capability

7.11.7.4 Emergency response capabilities may be restricted during construction and decommissioning due to an increased number of vessels and activities associated with the Proposed Development during both periods. Given the limited area of the Proposed Development, and the short timescales expected for the construction and decommissioning phases, it is considered that there is no risk of likely significant effect, and it is proposed that this impact be scoped out of the EIA.

7.11.8 Proposed Approach to the Assessment

7.11.8.1 The EIA will assess the potential impacts from construction, operational and decommissioning activities arising from the Proposed Development on the shipping and navigation activities identified within the study area and the desk-based review. The approach to EIA will follow the general approach outlined in **Chapter 5 EIA Methodology** of this Scoping Report.

7.11.8.2 Unless use of the Proposed Development area by other vessels is proved to be unexpectedly high a formal quantified navigational risk assessment is not proposed.

8. ENVIRONMENTAL TOPICS AND POTENTIAL EFFECTS: ALL PROJECT ELEMENTS

8.1 Introduction

8.1.1.1 This section of the Scoping Report considers the potential effects from construction, operation and maintenance and decommissioning activities of the Proposed Development. The following topics are to be considered in this section of the scoping report: Socio-economic Aspects, Waste Management, Major Accidents and Hazards and Communities and Human Health.

8.2 Socio-economic Aspects

8.2.1 Introduction

8.2.1.1 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.

8.2.1.2 The assessment of socio-economic effects is closely associated with the 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 Human Health section. It is not anticipated that primary data collection will be undertaken for either assessment.

8.2.2 Topic specific Regulatory Requirement and Guidance

8.2.2.1 The scope of the socio-economic assessment is based upon the following policies at the national and local level.

8.2.2.2 The NPS for Overarching Energy (EN-1), NPS for Oil and Gas Supply and Storage (EN-4)) and The NPPF (2019) constitute the relevant national planning policy context.

8.2.2.3 Part 5, Section 5.12 of NPS EN-1[109] identifies where a project is likely to have socio-economic impacts at a local or regional level, an assessment should consider all relevant socio-economic impacts which may include:

- the creation of jobs and training opportunities;
- the provision of additional local services and improvements to local infrastructure, including the provision of educational and visitor facilities;
- effects on tourism;
- the impacts of a changing influx of workers during the different Proposed Development phases (construction, operation and decommissioning); and
- Consideration of cumulative impacts whereby the Proposed Development was to receive consent along with other projects in the region and potential short-term impacts such as shortage of workers.

8.2.2.4 More broadly, impacts on local communities during the construction and operation of the Proposed Development should be considered. These may encompass impacts experienced

[109] 1938-overarching-nps-for-energy-en1.pdf (publishing.service.gov.uk)

by communities during the construction phase, such as disruption to local patterns of transport and access to services.

8.2.2.5 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.

Temporal Scope

8.2.2.6 The assessment will consider the construction, operational and decommissioning phases of the Proposed Development, noting that from a socio-economic perspective, the duration of potential effects may be both temporary and permanent in nature and will be identified as such.

Geographical Scope

8.2.2.7 The proposed study area has been determined by the extent and characteristics of the onshore components 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. Potential effects on groups engaged in commercial fisheries is addressed in **Section 7.8**.

8.2.2.8 The Hydrogen Storage Facility element of the Proposed Development is located within the ERYC area, in the civil parish of Aldbrough in the Yorkshire and Humber region. The closest settlement to the Hydrogen Storage Facility at 2 km is Aldbrough.

8.2.2.9 In addition, the traffic routes pass through, or in close proximity to, the civil parishes of Burton Constable, East Garton, Burton Pidsea, Burstwick, Elstronwick, Sproatley, Humbleton, and Hedon. All civil parishes listed are in the Mid Holderness ward of the East Riding of Yorkshire, aside from Hedon.

8.2.2.10 The traffic management route form the basis of the immediate zone of potential socio-economic impact. Given the interconnectivity of local and regional economies, a wider zone of potential impact will also be considered for this assessment. This zone will encompass the jurisdiction of East Riding of Yorkshire and wider Humber region within which this is situated**.**

Data Sources used in Scoping

8.2.2.11 The following data sources have been used to inform understanding of the baseline conditions described for population and socio-economic characteristics:

- East Riding of Yorkshire Population Estimates (East Riding of Yorkshire Intelligence Hub, 2020)[110];
- Office for National Statistics Labour Market Profiles (NOMIS) (Nomis, 2020)[111];
- Data East Yorkshire (East Riding of Yorkshire Intelligence Hub, 2020)[112];

[110] East Riding of Yorkshire Intelligence Hub (2020) Data Explorer. Available online: https://intel-hub.eastriding.gov.uk/data-catalog-explorer/indicator/I351

[111] Office for National Statistics (2020) Nomis: local authority profile. Available online: https://www.nomisweb.co.uk/reports/lmp/la/contents.aspx

[112] East Riding of Yorkshire Council (2020) East Riding Intelligence Hub. Available online: https://intel-hub.eastriding.gov.uk/

- English Indices of Deprivation (Ministry of Housing, Communities & Local Government, 2019)[113];
- East Riding Local Plan 2021 – 2029 (ERYC, 2016)[114]; and
- Projected job creation estimates.

8.2.2.12 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 Human Health section. The community profile will evolve as the assessment progresses and will also draw upon feedback from stakeholders. The profile sets the context of baseline conditions against which the assessment identifies how the Proposed Development may affect socio-economic conditions in the area.

8.2.2.13 The detailed community profile will be made available as part of the emergent assessment findings and will be annexed as part of the PEIR (and ES). A summary of the current understanding of baseline conditions is provided below.

8.2.3 Baseline Environment

Population and Demographics

8.2.3.1 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.

8.2.3.2 In 2020, the population of Aldbrough civil parish was estimated at 1,263. There has been a marginal decrease in population numbers, in recent years, for the parish as the 2012 estimate was 1,285. The 2020 population estimate for the Mid Holderness Ward is 13,769 which has also seen a marginal decrease since 2012. Aldbrough and the surrounding parishes are classed as rural and are considered representative of the wider East Riding area. The 2020 total population estimate for East Garton was 191.

8.2.3.3 Aldbrough has an increasingly ageing population, indicative of wider trends in the county of East Riding. However, this trend is particularly evident in the Aldbrough parish as 19.5% of the population are aged between 65-74 compared to 14.4% for the whole of the East Riding of Yorkshire region. This is in contrast with the closest city of Kingston upon Hull which has a greater number of younger people, particularly between 24 and 35 years old[115]. East Garton also has a relatively young population with only 8.4% of the population aged between 65-74 and 15.7% aged between 0-15.

Economy and Employment

8.2.3.4 As reported in the 2011 census, 63.7% of the population in Aldbrough was economically active in some form of employment (full/part-time and self-employed) and 22.2% of the population was retired. The employment rates of Aldbrough fall below the national average, over the last decade, of between 70- 76%. In East Garton, 71.6% of the population are economically active (full/part-time or self-employment) and 12.9% of the population are retired. Employment rates in East Garton fall within the national average range.

[113] 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

[114] 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/

[115] Kingston upon Hull Data Observatory (2020) Available at: Population - UTLA | Kingston upon Hull, City of | InstantAtlas Reports [accessed on: 02/09/2022].

8.2.3.5 Additionally, a larger proportion of the population of Aldbrough is retired compared to the national average of 13.7% in 2011. The Mid Holderness Ward overall had a higher rate of employment, at the time of the 2011 census, of 68.9% with 20.6% retired. Hedon similarly recorded a higher employment rate and a lower level of retirement at the time, with 68.8% and 20% respectively. This once again illustrates the aging population of Aldbrough and the youthful population of East Garton.

8.2.3.6 Within Aldbrough the dominant form of employment is within skilled trades such as agriculture, forestry, fishing and repair of motor vehicles and motorcycles[116]. This trend is repeated at the ward level. Skilled trades are also the dominant form of employment in Elstronwick, Burton Constable, Burton Pidsea, East Garton, Burstwick and Sproately. The dominant form of employment in the Hedon parish, however, is within human health and social work activities. In East Garton 11.2% of the population are in professional occupations while 26.7% are in skilled trades.

8.2.3.7 Gross Value Added (GVA) per head in 2020 was £20,532 for East Riding in 2020, compared to £29,757[117] per head for England.

Tourism

8.2.3.8 In the County of East Riding, the role that tourism plays to the local economy varies widely. The focus is on areas along the east coast, 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[118]. The Hydrogen Storage Facility location near the coast between Hornsea and Withernsea means that there are several tourism destination areas within 2 km of the Scoping Boundary. Nearby campsites and caravan parks include Newton Shores, Bailwood Scout Campsite and Aldbrough Leisure Park. The Bailwood Scout Campsite is less than 100 m from the Hydrogen Storage Facility. Newton shores is less than 1 km from the Scoping Boundary and Aldbrough Leisure Park is 2 km from the Hydrogen Storage Facility. Beyond these receptors there is limited tourism value within either special scale of the study area. That said, the East Riding Economic Strategy 2018-2022[119] states that it will "*continue to develop and support nature tourism opportunities*"[120]. 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 feature and the rich heritage of the landscape, nature conservation sites and built environment*" as set out in the East Riding Local Plan 2012 – 2029[121].

8.2.3.9 Given that tourism may represent cross-sectional employment the tourism receptors will form part of the environmental baseline underpinning the assessment.

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[116] Nomis Local Area Report (2020) Available at: Local Area Report for areas in England and Wales - Nomis (nomisweb.co.uk) [accessed on: 31/08/2022].

[117] Office for National Statistics (2020) Available at: Regional gross value added (balanced) per head and income components - Office for National Statistics (ons.gov.uk) [accessed on: 06/09/2022].

[118] East Riding of Yorkshire Council (2021). Tourism and attractions. Available at: https://www.eastriding.gov.uk/leisure/tourism-and-attractions/ [accessed on 01/09/2022]

[119] 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/

[120] East Riding of Yorkshire Council (2011). Economic Strategy 2018-2022. Available at: https://downloads.eastriding.org.uk/corporate/plans-and-policies/all-plans-policies-and-strategies/East%20Riding%20Economic%20Strategy%202018-2022.pdf [accessed on 01/09/2022]

[121] East Riding Local Plan 2012 – 2029 (2016) Available at: www.eastriding.gov.uk [accessed on: 03/09/2022].

Transport Links

8.2.3.10 The assessment will include consideration of any key travel to work areas and potential effects on local businesses.

8.2.3.11 As noted in the traffic and transport assessment (see **Section 6.10**), a designated haulage route has been approved for construction and operational traffic access to the Hydrogen Storage Facility. The approved haulage 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 Hydrogen Storage Facility is located.

8.2.3.12 The haulage 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 haulage route does, however, pass directly through four settlements between the Hydrogen Storage Facility 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.

8.2.3.13 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 should be included in stakeholder engagement and consultation material. A detailed Traffic Management Plan will be developed and communicated with local stakeholders.

Residential Properties

8.2.3.14 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.

Wider Local Receptors

8.2.3.15 The assessment will, where data allows, map and consider potential effects on the following key categories of local receptors or facilities:

- local businesses;
- any local areas of high amenity or tourism value that may be affected temporary or permanently; resulting in a loss of use;
- any land identified for development that may be affected by land-take required for the Proposed Development.

8.2.3.16 The assessment will also draw upon direct engagement and feedback with stakeholders associated with such receptors, and local communities generally, to understand where and how such receptors may be affected.

8.2.4 Likely Significant Effects to be Considered in the EIA

8.2.4.1 The socio-economic assessment will consider the following scope of issues and potential effects:

- use/reuse of previously undeveloped and previously developed land;
- employment and expenditure in the local and regional economy during construction;
- job creation during construction and operation;

- potential disruption for the local community during construction and operation including additional traffic and pressure on specific businesses and/or community infrastructure and services; and
- the impact of inward investment on the local and wider regional economy;
- economic benefits arising from direct and indirect expenditure associated with the Proposed Development, for example through placing local orders for goods and services and maintenance;
- net economic gain taking account of leakage and displacement; and
- contribution to the security of energy supply both regionally and nationally, thereby supporting economic activities locally and contributing to achieving the aims of NPS EN-1.

8.2.4.2 Community effects, other than the socio-economic effects set out above and those considered elsewhere in this Scoping Report, such as landscape and visual effects, are considered in the Human Health assessment.

8.2.4.3 The assessment of likely effects on the local, regional, and national economies during construction, operation and decommissioning of the Proposed Development will consider the scale of the following:

- Direct economic effects: jobs and GVA that are wholly or largely related to construction, decommissioning and operation of the Proposed Development.
- Indirect economic effects (positive and negative): jobs and GVA generated in the areas of influence in the chain of suppliers of goods and services to the direct Proposed Development activities.
- Induced economic effects: jobs and GVA created by direct and indirect employees' spending in the local authority area or in the wider economy.
- Wider socio-economic effects (positive and negative): employment and income generated in the national / regional economy related to the Proposed Development.

8.2.5 Effects Scoped out of the EIA

8.2.5.1 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).

8.2.5.2 Whilst the assessment does not consider it likely that there will be a significant effect on tourism in the area, the assessment will nonetheless consider this further to ensure that stakeholder feedback is considered and specifically in relation to local businesses such as those services holiday rentals.

8.2.5.3 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.

8.2.6 Proposed Approach to the Assessment

8.2.6.1 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.

8.2.6.2 The evaluation of the significance of effects will involves the assessment of how the potential changes to baseline conditions might result in socio-economic effects. There is no legislation relevant to the assessment of socio-economic effects. The methodology for assessment of socio-economic effects has been developed with reference to good practice EIA guidance, such as that published by IEMA and from considerable experience of socio-economic impact assessment of similar developments.

8.2.6.3 The definitions of receptor sensitivity, magnitude, and significance presented Table 8.1, Table 8.2 and Table 8.3 are based on professional judgement and precedent set in similar assessments.

Socio-economic Receptor Sensitivity

8.2.6.4 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 the level of usage by sensitive or vulnerable social groups. These are defined in Table 8.1.

Table 8.1: 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.

Magnitude of Impacts

8.2.6.5 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 8.2) 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 8.2: Magnitude of Impact (adverse and positive)

Impact Magnitude	Description
Large	The impact would dominate over 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 (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).

Significance of Effects

8.2.6.6 The level of significance is determined by the sensitivity of the receptor and magnitude of the impacts upon them (see Table 8.3). 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 are not considered to be 'significant'.

Table 8.3: 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

8.2.6.7 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 receptors; and
- Adverse – disadvantageous or negative effect on an impact area/defined receptors.

8.2.7 Mitigation

8.2.7.1 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;
- 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; 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.

8.2.7.2 Mitigation will be identified and discussed with stakeholders, as appropriate, as the assessment evolves.

8.3 Waste Management

8.3.1 Introduction

8.3.1.1 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.

8.3.1.2 The assessment will especially focus on the potential for waste generated in the construction and operational phase of the Proposed Development to present risks to receptors, or to the risk of exceeding the planned landfill capacity in the Yorkshire and Humber Region during the Proposed Development duration.

8.3.1.3 Potential effects associated with discharge of wastewater (brine) generated by solution mining of the caverns to the North Sea is considered as part of the marine assessment (see **Section 7.3**).

8.3.2 Topic-specific Regulatory Requirements and Guidance

8.3.2.1 The NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4) all contain aspects relating to waste and waste management and are applicable to this assessment.

8.3.2.2 Key items of policy and legislation specifically relevant to waste generation and management for the Proposed Development are outlined below.

Control of Pollution (Amendment) Act 1989

8.3.2.3 The Control of Pollution (Amendment) Act 1989 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”.

8.3.2.4 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.

Waste (England and Wales) Regulations (2011)

8.3.2.5 The Waste (England & Wales) Regulations 2011 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.

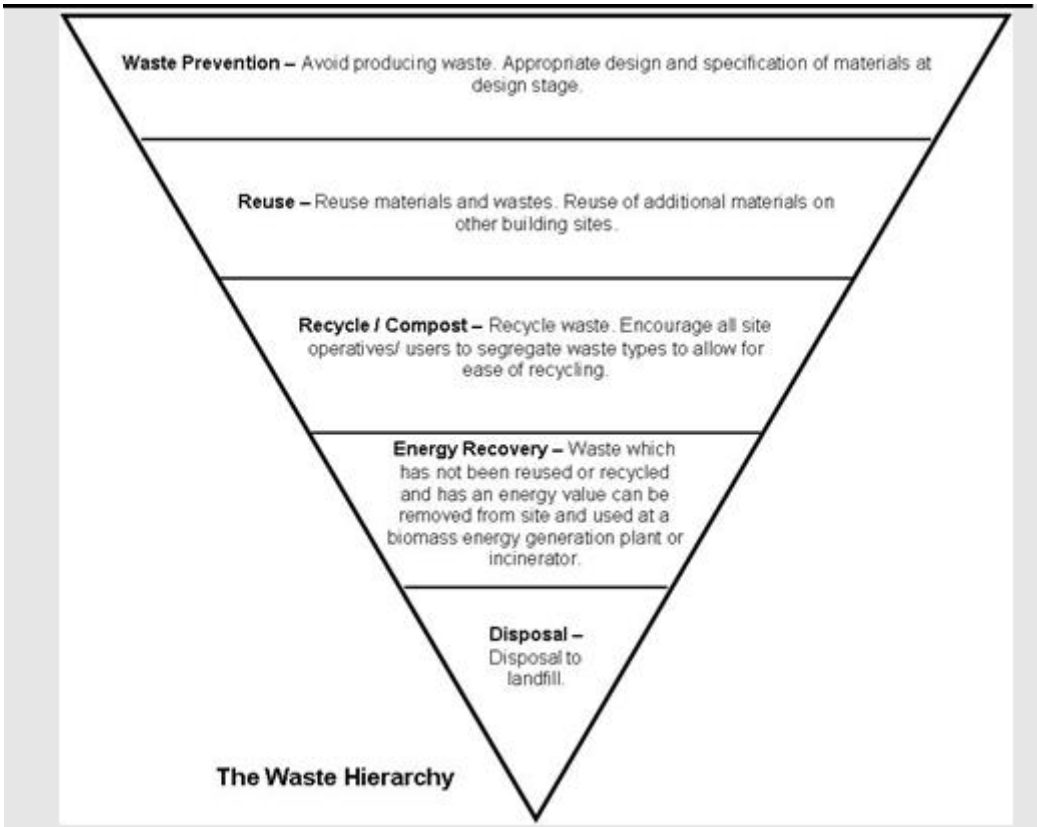
8.3.2.6 The regulations aim to protect the environment and human health by preventing or reducing the generation of waste, reducing the adverse impacts of the generation and management of waste, and reducing the overall impacts of resource use.

8.3.2.7 The regulations implement the revised WFD 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.

8.3.2.8 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 as seen in Figure 8.1.

Figure 8.1: The Waste Hierarchy



Waste (England and Wales) (Amendment) Regulations 2014

8.3.2.9 These regulations amend the Waste (England and Wales) Regulations 2011, 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.

Controlled Waste (England and Wales) Regulations 2012

8.3.2.10 Under these regulations, 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.

The Hazardous Waste (England and Wales) Regulations 2005

8.3.2.11 These regulations 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.

- Under the Regulations, all industrial and commercial premises producing more than 500 kg of hazardous waste have to notify their existence to the EA. In practice, the Environmental Agency released updated guidance in this regard in April 2016 which withdrew the need for such notification.

8.3.2.12 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 type;
- the locations of origin and destination of the waste; and
- the consignment notes with a unique number ('consignment note code').

Waste Management Plan for England 2021

8.3.2.13 The Waste Management Plan (WMP) for England (DEFRA, 2021) fulfils the requirements of the Waste (England and Wales) Regulations 2011 (as amended) for the WMP 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.

8.3.2.14 The 2021 Plan supersedes the previous WMP for England and includes changes to WMP 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)

8.3.2.15 This Code of Practice (CoP) serves the following purposes:

8.3.2.16 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.

8.3.2.17 It describes an auditable system to demonstrate that this CoP has been adhered to.

8.3.2.18 The EA 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 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.

8.3.3 Baseline Environment

Data Sources used in Scoping

8.3.3.1 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 EA Waste Data Interrogator[122].

Description

8.3.3.2 The baseline conditions for the assessment will establish the projected total volume and the existing volume of waste materials received by registered landfills, and in Yorkshire and The Humber Region. This information will provide a baseline to assess the effects of construction (including drilling), operation and decommissioning of the Proposed Development on the available landfill capacity, and the volume of waste delivered to receiving landfills annually.

8.3.3.3 A desktop review will provide information on the distance and capacity of registered landfills to determine facilities local to the Proposed Development.

Existing Landfill Capacity and Inputs

8.3.3.4 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 Regions as of 2021 is shown in Table 8.4.

[122] EA Waste Interrogator 2021 (v3): 2021 Waste Data Interrogator - Wastes Removed (Excel) - Version 3

Table 8.4: Operational landfill facilities within Yorkshire and The Humber Region (2021)[122]

Sub Region	Humber	North Yorkshire	South Yorkshire	West Yorkshire
Number of operational facilities	12	7	8	14

8.3.3.5 Within the East Riding of Yorkshire, there are six current (2021) registered landfill facilities as shown in Table 8.5.

Table 8.5: Registered Landfill Facilities within East Riding of Yorkshire in 2021[122]

Facility Address	EA Area	Former Planning Region	Former Planning Sub-Region	Local Authority	Site Type
Little Weighton Cutting Landfill, C/o Dispit Ltd, Albion Lane, Willerby, Hull, East Yorkshire, HU10 6DP	Yorkshire	Yorkshire & 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 & Humber	East Riding of Yorkshire	Former Humberside	L05 – Inert Landfill
Milegate Extension Landfill Site, Catwick Lane, Driffield, YO25 8SA	Yorkshire	Yorkshire & Humber	East Riding of Yorkshire	Former Humberside	L04 – Non Hazardous
Riplingham Cutting Landfill, Riplingham HU20 3UP	Yorkshire	Yorkshire & Humber	East Riding of Yorkshire	Former Humberside	L05 – Inert Landfill
Moor Lane, Carnaby YO16 4UU	Yorkshire	Yorkshire & Humber	East Riding of Yorkshire	Former Humberside	L04 – Non-Hazardous
Market Weighton Road, Holme-on-Spalding Moor YO43 4ED	Yorkshire	Yorkshire & Humber	East Riding of Yorkshire	Former Humberside	L02 – Non-Hazardous Landfill With Stable Non Reactive Hazardous cell
Leatherdog Lane, Brough HU15 2RF	Yorkshire	Yorkshire & Humber	East Riding of Yorkshire	Former Humberside	L04 – Non-Hazardous

8.3.3.6 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 8.6.

Table 8.6: Remaining Landfill Capacity for East Riding and Yorkshire and the Humber in 2021[122]

Local Authority	Hazardous	Inert	Non-Hazardous (SNRHW)	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)	700,000 m^3	25,282,000 m^3	1,243,000 m^3	45,196,000 m^3	-1,465,000 m^3

Key Sensitivities

8.3.3.7 Registered landfill sites used by the Proposed Development may be affected by construction (including drilling), operation and decommissioning works through a material increase in the volume of waste types received. This is most likely to occur during the construction (including drilling) and decommissioning phase of the Proposed Development, where projected waste volumes are expected to be the highest.

8.3.3.8 Residential receptors on the routes from the Proposed Development to the landfill facilities used may be affected by an increase in traffic, though this will be assessed as part of Traffic and Transport (see **Section 6.10**).

8.3.3.9 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 6.3** and **Section 6.4**.

8.3.4 Project Basis for Scoping Assessment

Construction Phase

8.3.4.1 The greatest potential for impacts regarding waste management will be during the construction phases from activities that mainly include:

- site preparation, levelling and possible generation of surplus soil and subsoil that need to be removed from the site;
- drilling generating cuttings;
- excavations and piling; and
- potential encounters with contaminated materials.

Operational Phase

8.3.4.2 Wastes arising during operation will be significantly less in volume than those during construction but may include materials that require specialist treatment and disposal.

Decommissioning

8.3.4.3 Decommissioning will take place after an anticipated 30 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.

8.3.5 Mitigation

8.3.5.1 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.

8.3.5.2 During the construction phase of the Proposed Development, the contractor will be required to develop and implement a construction phase WMP. It is likely that a separate drilling WMP will also be required. The WMPs will be developed in detail by the appointed contractors and outline documents will be included in the PEIR and 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.

8.3.5.3 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. Environmental Permitting Regulations 2016. The DoW; CoP will be employed to promote the re-use and repurposing soils wherever possible.

8.3.5.4 Should any contamination be encountered, all contaminated materials will be characterised both chemically and physically in line with BS EN 14899:2005 'Characterization of Waste - Sampling of Waste Materials to classify the waste and ensure correct disposal.

8.3.5.5 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.

8.3.6 Likely Significant Effects to be Considered in the EIA

8.3.6.1 Table 8.7 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.

8.3.6.2 As decommissioning will be more than 30 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.

Table 8.7: Likely Effects – Waste Management

Proposed Development Activity and Impact	Embedded Mitigation Measures	Anticipated Magnitude	Anticipated Importance/ Sensitivity	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	Small	Medium	Minor	Scoped In	Options to re-use excess soils under the DoW: CoP Update and confirm landfill capacities
Handling and disposal of construction wastes placing significant burden on Yorkshire and The Humber Region landfill capacity	Principles set out in the Waste Hierarchy	Negligible	Medium	Not significant	Scoped In	Segregation of different waste stream and options to re-use and recycle. Update and confirm landfill capacities
Handling and disposal of drilling wastes placing significant burden on Yorkshire and The Humber Region landfill capacity	Principles set out in the Waste Hierarchy	Small	Medium	Minor	Scoped In	Options to re-use drilling arisings under the DoW: CoP Update and confirm landfill capacities
Handling and disposal of waste generated by decommissioning placing significant burden on Yorkshire and The Humber Region landfill capacity	Principles set out in the Waste Hierarchy	Small	Medium	Minor	Scoped Out. 30^{+} years in the future, and environmental effects considered to be no more than construction.	N/A

8.3.7 Effects Scoped Out of the EIA

8.3.7.1 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).

8.3.7.2 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.

8.3.7.3 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 6.3** and **Section 6.4** and will not be included in the scope of the waste assessment.

8.3.7.4 Potential effects associated with discharge of wastewater (brine) generated by solution mining of the caverns to the North Sea is considered in **Section 7.3.**

8.3.8 Proposed Approach to the Assessment

Proposed Development Waste Generation

8.3.8.1 Waste will be generated during construction (and drilling), 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.

8.3.8.2 Estimates of the volume and composition of waste generated at the Hydrogen Storage Facility will be established for the assessment using benchmark waste data. Estimated waste composition data will be derived from new build industrial buildings published by Waste and Resources Action Programme (WRAP)[123] (WRAP, 2009) for the Hydrogen Storage Facility. Total provisional construction waste volumes will be estimated using Smartwaste Waste Benchmark Data[124] based on the development footprints for the various elements of the Proposed Development.

8.3.8.3 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.

8.3.8.4 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.

Assessing Effects on Landfill Capacity

8.3.8.5 The effects of waste generated during construction at the Proposed Development will be assessed by:

[123] WRAP 2009: Waste Resources and Action Program 2009. Waste Benchmarking and Composition estimates for Residential and Industrial Construction

[124] Smartwaste Benchmark Dataset: Building Research Establishment 2008. https://kb.breeam.com/knowledgebase/int13-wst-01-cn3-appears-to-suggest-that-criteria-1-4-can-only-be-met-through-use-of-bre-smartwaste-system-is-this-correct/

- 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 Site to the baseline landfill capacity and assessing the effect on the capacity and ability of landfill sites to accept the waste.

8.3.8.6 In order to assess the significance of the 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[125] (EP Waste Management, 2020).

Table 8.8: Evaluation on the significance of the Proposed Development 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

[125] EP Waste Management 2020: EP UK Investments Document Ref. 6.2 Environmental Statement: Volume I Waste Management 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

8.4 Major Accidents and Hazards

8.4.1 Introduction

8.4.1.1 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.

8.4.2 Topic-specific Regulatory Requirement and Guidance

EIA Regulations

8.4.2.1 The Infrastructure EIA Regulations 2017 require a Major Accidents and Disasters (MA&D) Assessment to identify potential significant adverse effects of the Proposed Development on safety and the environment.

8.4.2.2 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.

Control of Major Accident Hazards

8.4.2.3 The principal health and safety legislation covering onshore storage of hazardous gases underground is the COMAH Regulations 2015. 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 require the operators to take all necessary measures to prevent major accidents and limit their consequences to both people and the environment.

8.4.2.4 Underground storage sites come 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.

8.4.2.5 The Hydrogen Storage Facility (i.e. salt caverns, wellheads, interconnecting pipework and import and export processing facilities, including compressors), will together comprise the COMAH establishment.

8.4.2.6 The COMAH Regulations requires upper-tier sites to prepare a Pre-operational 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. There is a requirement for a separate Pre-construction Safety Report to also be prepared for an upper-tier site.

8.4.2.7 The Safety Report is required to be submitted to the CA in a reasonable time before start of operation (e.g. 3 to 6 months). The report must address the criteria set out in the Safety Report Assessment Manual (SRAM) management system for technical, predictive (risk assessment), descriptive, environmental and emergency response criteria.

8.4.2.8 The COMAH Regulations also require 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.

8.4.2.9 The existing storage and processing facility (AGS) is an upper-tier COMAH site due to the inventory of natural gas and will be part of a ‘domino group’ with the Proposed Development in terms of major accident risk and emergency response. Hazards potentially

impacting on either of the adjacent sites will require consideration as part of the COMAH compliance, including As Low As Reasonably Practicable (ALARP) demonstration and emergency response. The operators in the domino group must co-operate with each other in supplying any relevant information to the local authority.

Land Use Planning and Hazardous Substances Consent

8.4.2.10 Hazardous Substances Consent (HSC) is required to be obtained from the Hazardous Substances Authority (HSA), in this case the ERYC, 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.

8.4.2.11 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.

8.4.2.12 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.

Borehole Safety

8.4.2.13 The Boreholes Safety and Operations Regulations 1995 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.

8.4.2.14 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.

Other Relevant Legislation and Guidance

8.4.2.15 The following legislation and guidance will be considered and followed (where applicable):

- The Institute of Environmental Management and Assessment guidance document 'Major Accidents and Disasters in EIA: A Primer';
- The Health and Safety at Work etc. Act 1974 (HSWA);
- The Construction (Design and Management) (CDM) Regulations 2015;
- The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996;
- Chemicals and Downstream Oil Industries Forum Guidelines, Environmental Risk Tolerability for COMAH Establishments;
- Guidelines for Environmental Risk Assessment and Management (DEFRA, 2011);
- HAZOP and HAZAN: Identifying and Assessing Process Industry Hazards, 1992;
- Process Plants – a Handbook for Inherently Safer Design, 2006;
- ISO 31000:2009 Risk Management principles and guidelines (The International Standards Organization, 2009); and
- Reducing Risks, Protecting People: HSE's decision making process, (HSE, 1999).

8.4.3 Baseline Conditions

Data Sources used in Scoping

8.4.3.1 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 MA&D hazards associated with the Proposed Development.

Description

8.4.3.2 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 or pipelines such as AGS or the proposed hydrogen pipeline.

Key Sensitivities

8.4.3.3 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.

8.4.3.4 The key sensitivities in terms of human, ecological, cultural heritage and other assets are identified and described in the relevant topic sections.

8.4.4 Project Basis for Scoping Assessment

8.4.4.1 The following key infrastructure will be included in the MA&D assessment in the EIA:

- underground hydrogen storage;
- processing facilities;
- wellhead and associated facilities;
- hydrogen venting (or flaring); and
- marine infrastructure.

8.4.5 Mitigation

8.4.5.1 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. Prevention and mitigation measures are identified in formal Hazard Studies carried out at different stages of the Proposed Development.

8.4.5.2 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.

8.4.6 Likely Significant Effects to be Considered in the EIA

8.4.6.1 The MA&D Assessment will cover all aspects of the Proposed Development that could have potential significant adverse effects on people and the environment.

8.4.6.2 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.

8.4.6.3 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;
- impacts on adjacent pipelines such as the proposed hydrogen pipeline; and
- drilling hazards.

8.4.7 Effects Scoped out of the EIA

8.4.7.1 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).

8.4.8 Proposed Approach to the Assessment

8.4.8.1 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 MAH, 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.

Specific Methodologies

8.4.8.2 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.

8.4.8.3 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 consideration of 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.

Assessment Criteria

8.4.8.4 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 8.9 to categorise threats and hazards, based on severity of the consequence and likelihood.

8.4.8.5 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.

8.4.8.6 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.

8.4.8.7 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 8.9 below.

Table 8.9: 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

8.4.8.8 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 8.10: 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

8.5 Human Health

8.5.1 Introduction

8.5.1.1 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.

8.5.1.2 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.

8.5.1.3 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 including socio-economic, noise, air quality, landscape and visual, and traffic and transport assessments. Cross-reference is, therefore, made to these assessments as appropriate.

8.5.2 Topic specific Regulatory Requirement and Guidance

Regulatory requirements

8.5.2.1 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 and best practice.

8.5.2.2 The assessment will therefore 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.

8.5.2.3 The NPS for Overarching Energy (EN-1) and NPS for Oil and Gas Supply and Storage (EN-4) all make reference to impacts on human health and well-being. As such, they are also considered relevant to this assessment.

8.5.2.4 The assessment will also be undertaken consistent with the relative objectives of The East Riding Local Plan 2021-2029 which includes requirements for retaining and enhancing the East Riding's high-quality environment as well as ensuring strong and healthy communities as key considerations in the development of the area and the Proposed Development's progressed in the fulfilment of this.

Guidance

8.5.2.5 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 SEA and EIA across the World Health Organisation (WHO) European Region, 2022[126].
- Human health: Ensuring a high-level of protection. A reference paper on addressing Human Health in Environmental Impact Assessment, European Public Health Association, 2020[127].
- Health Impact Assessment in Spatial Planning, Public Health England, 2020[128].
- Rapid Health Impact Assessment Tool, National Health Service (NHS) HUDU, 2019[129].

8.5.2.6 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.

8.5.2.7 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.

8.5.2.8 The assessment will reflect the learnings and recommendations set out in the aforementioned guidance and will also be informed by the literature review which is being conducted to inform the detailed assessment of impacts.

Methodology

8.5.2.9 The WHO defines health as; "*a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*".

8.5.2.10 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.

8.5.2.11 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.

8.5.2.12 Within this report the health determinants have been grouped into the following overarching categories:

- Physical Environment: the physical characteristics and conditions of an area.
- Living Environment: conditions of the area where people live as well as the relation and sense of character they associate with the area.
- Social Capital: represents the degree of social cohesion which exists in communities. It refers to the processes between people which establish networks,

[126] https://www.who.int/europe/publications/i/item/WHO-EURO-2022-4882-44645-63360

[127] https://eupha.org/repository/sections/HIA/HumanHealthEnsuringProtectionSummary.pdf

[128] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/929230/HIA_in_Planning_Guide_Sept2020.pdf

[129] https://www.healthyurbandevelopment.nhs.uk/wp-content/uploads/2019/10/HUDU-Rapid-HIA-Tool-October-2019.pdf

norms, and social trust, and facilitate coordination and co-operation for mutual benefit.

- Economics: the status and conditions of an area in terms of economic status and opportunities available.

8.5.2.13 Consideration of the range of these key categories of determinants enables a comprehensive assessment to be undertaken of the range of potential effects which may be experienced, primarily by those living in the communities within closest proximity to the Proposed Development.

8.5.2.14 The approach to assessment of human health and wellbeing will include the following key stages:

- the development of a detailed community profile and literature review to inform the understanding of baseline conditions in the area;
- detailed consideration of feedback from stakeholders to 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.

Geographical Scope

8.5.2.15 For the assessment of impact on human health, the study area has been determined by the extent and characteristics of the onshore components of the Proposed Development and the communities directly and indirectly affected. **Section 6.10** above details the designated haulage route for the construction phase of the Proposed Development.

8.5.2.16 The smallest jurisdictional boundaries are the Lower Layer Super Output Areas (LSOAs) of E01013029, E01013028, E01013030 and E01013078 in the Mid Holderness Ward. LSOAs are geographical areas that are designed to improve the reporting of small area statistics. They are the lowest geographical level at which census estimates are provided. LSOAs are designed to contain between 1000-3000 residents or 400-1200 households. Reporting at this level allows for more accuracy and identification of statistical variances that may be lost at parish or council level. Where possible, these are the basis of the study area because they are the communities that are most likely to experience direct and/ or greatest impacts.

8.5.3 Baseline Conditions

Data Sources used in Scoping

8.5.3.1 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 Deprivations (Ministry of Housing, Communities & Local Government, 2019130);
- Public Health England Public Health Profiles (Public Health England, 2019);
- East Riding of Yorkshire Intelligence Hub;

[130] Ministry of Housing, Communities and Local Government (2019) Indices of Deprivation. Available online: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

- East Riding Local Plan 2021-2029 and information collated by the Council; and
- Health and Wellbeing Strategy 2019-2022 (ERYC, 2019131).

8.5.3.2 A detailed community and health profile will be evolved to support the evolving assessment. Both the profile and subsequent assessment will usefully draw upon the findings of wider environmental assessments, including Air Quality, Traffic and Transport, Noise and Vibration and Socio-economic Aspects to inform the profile and baseline conditions for the assessment and overarching assessment of cumulative effects.

8.5.3.3 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.

Description

Physical Environment

8.5.3.4 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.

8.5.3.5 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.

Socio-economic deprivation

8.5.3.6 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.

8.5.3.7 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 within East Riding certain areas such as Bridlington are in the 10% most deprived in the country. For Mid Holderness the areas surrounding Aldbrough and East Garton are 30-40% most deprived, the worst score for the ward. Deprivation in Hedon is highly disparate, with part being in the 20-30% most deprived in the country, and other parts being in the 30-40% least deprived[132] [OBJ]

8.5.3.8 Areas of increased deprivation within the council create health inequalities. In the most deprived areas, the life expectancy for men is 6.3 years lower than in the least deprived areas. For women life expectancy is 3.8 years lower. 12.2% of children live in low-income families in the East Riding of Yorkshire. The County has a high rate of internal disparity in deprivation.

8.5.3.9 In the least deprived neighbourhood of the region only 1.4% are income deprived whereas in the most deprived neighbourhood, 44.4% of people are income deprived. This level of disparity will result in varying health outcomes throughout the region. Areas within the ERYC, such as Goole, Bridlington and Withernsea, have some of the highest levels of poverty in England. These areas are characterised by low incomes, high unemployment,

[131] 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/

[132] East Riding of Yorkshire Intelligence Hub Parish Profiles (2020) Available at: Parish Profile V2 Migration | Airmyn | InstantAtlas Reports (eastriding.gov.uk) [accessed on: 30/08/2022].

poor health, higher levels of crime and anti-social behaviour and low educational achievement. Some of the areas within the study site may include relatively remote areas with indications of poverty and these will be further assessed to understand if there are any differential impacts on human health and wellbeing which may arise from the Proposed Development. The income deprivation rate for the council is an average of 9.6%.[133]

Economic activity

8.5.3.10 As reported in the 2011 census, 63.7% of the population in Aldbrough was economically active in some form of employment (full/part-time and self-employed) and 22.2% of the population was retired. The employment rates of Aldbrough fall below the national average, over the last decade, of between 70- 76%. In East Garton, 71.6% of the population are economically active (full/part-time or self-employment) and 12.9% of the population are retired. Employment rates in East Garton fall within the national average range.

8.5.3.11 At the ward level, the Mid Holderness Ward overall had a higher rate of employment, at the time of the 2011 census, of 68.9% with 20.6% retired. Hedon similarly recorded a higher employment rate and a lower level of retirement at the time, with 68.8% and 20% respectively. This once again illustrates the aging population of Aldbrough. Within Aldbrough the dominant form of employment is within trades such as agriculture, forestry, fishing and repair of motor vehicles and motorcycles. This trend is repeated at the ward level. Skilled trades are also the dominant form of employment in Elstronwick, Burton Constable, Burton Pidsea, East Garton, Burstwick and Sproately. In East Garton 11.2% of the population are in professional occupations while 26.7% are in skilled trades. The dominant form of employment in the civil parish of Hedon, however, is within human health and social work activities.

8.5.3.12 GVA per head in 2020 was £20,532 for East Riding in 2020, compared to £29,75713 per head for England. This represents a significantly lower level of GVA in the area, relative to the national picture.

State of health and wellbeing

8.5.3.13 A broad range of metrics are used and tracked by Public Health England to assess the relative state of health and wellbeing across the country and within regional and local contexts. The local authority profile for East Riding of Yorkshire can be reviewed in full online[134] and will be used to inform the detailed community profile for the assessment.

Physical health and wellbeing

8.5.3.14 As previously noted, there are a range of key metrics which Public Health England tracks as part of its monitoring of the state of the physical health of the population. A selection of these metrics is detailed below but they will be reported in full within the community profile.

- Life expectancy and cause of death: Heart attacks, cancer, under 75 cardiovascular disease mortality, and under 75 cancer mortality rates are lower than the national average.
- Behavioural risk factors: Alcohol-related hospital admissions in residents under 18 years of age occurs at a similar rate to the England average and in adults, this rate is also not significantly different to national levels. Smoking prevalence in adults,

[133] Office for National Statistics Exploring Local Income Deprivation (2021). Available at: Exploring local income deprivation (ons.gov.uk) [accessed on: 01/09/2022].

[134] https://fingertips.phe.org.uk/static-reports/health-profiles/2019/E06000011.html?area-name=East%20Riding%20of%20Yorkshire

percentage of active adults, and percentage of adults classified as overweight or obese are also not significantly different to national averages.

- Child health: The childhood obesity rate (18%) outperforms the national average. As does the teenage conception rate and infant mortality rate. However, the percentage of smoking during pregnancy is significantly worse than national levels.
- Injuries and ill health: Notably, the rate of those killed and seriously injured on roads is worse than the national average. This will be considered in relation to potential impacts and appropriate mitigation, to protect the health and wellbeing of residents in proximity to the Proposed Development.

Mental health and wellbeing

8.5.3.15 Across the UK, there is a recognised need to further monitor and gather data on mental health and wellbeing. The current available data for the ward and wider region does not indicate any notable disparities between the mental health and wellbeing of local communities and that of the national average, for example, the suicide rate for East Riding is not significantly different than that of the UK generally. One notable exception of this, however, is hospital admissions for intentional self-harm, which are significantly better than the national average.

8.5.3.16 It is recognised that any proposed development can generate uncertainty and potential effects on mental health through heightened concerns or anxiety about what is being proposed and how this will impact local communities. It will be important that the assessment identifies and reflects community perceptions, in particular from a health perspective, to understand where concerns may exist and what mitigation can be identified to address these. The assessment will draw upon the programme of stakeholder engagement and consultation activity which will be undertaken but also proactively reach out directly to health stakeholders to inform the assessment and identification of mitigation.

Health inequalities

8.5.3.17 There are recognised health inequalities within the area and an identified need to improve the quality of life and specially health and wellbeing for disadvantaged sections of the community.

8.5.3.18 In the Health and Wellbeing Strategy 2019-2022 the ERYC acknowledged that “there is a large gap between life expectancy and healthy life expectancy. This means a proportion of our residents live with preventable, multiple long-term conditions for a large part of their lives.[135]

8.5.3.19 It was recognised that human health and wellbeing can be complex and must be considered along with the wider determinants of health such as living and working conditions, income, education, housing, food security, access to services (water, sanitation) and community networks.

8.5.3.20 The community profile which will be developed as part of the assessment of human health and wellbeing will collate relevant data pertaining to the breadth of these determinants, which will inform the baseline for the assessment of potential impacts of the Proposed Development. The assessment will also assess the potential for the Proposed Development to impact such inequalities – positively or negatively.

[135] East Riding of Yorkshire Council Health and Wellbeing Strategy 2019 – 2022 (2019). Available at: Microsoft Word - HWBS 2019 FINAL (eastriding.gov.uk) [accessed on: 05/09/2022].

Housing stock, community facilities and social capital

8.5.3.21 According to the Valuation Office Agency Council Tax data records, there are 153,080 dwellings in East Riding, the majority of which are semi-detached. Within Holderness the majority (31%) are bungalows. The minimum housing need expected for East Riding between 2019-2029 is 935 per annum.[136]

8.5.3.22 No schools appear to be within the Scoping Boundary.

8.5.3.23 Within the immediate study area there are small healthcare facilities such as a GP Practice in Aldbrough and the Holderness Therapy Centre (physiotherapy) in Burton Pidsea. The nearest hospitals are the East Riding Community Hospital in Beverley and the Withernsea Community Hospital.

8.5.3.24 The communities in and around Aldbrough and East Garton have the existing gas storage facility operations in relatively close 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 some familiarity with industry, it does not preclude potential concerns over further development or redevelopment at the site.

Assessment Criteria

8.5.3.25 The assessment will consider the effects of the Proposed Development during the construction and operational phases within the context of the policy framework and existing/future baseline conditions.

8.5.3.26 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.

Mitigation and Residual Effects

8.5.3.27 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.

8.5.3.28 Mitigation measures will be recommended where any significant adverse effects are anticipated. Residual effects will be assessed and clearly set-out in the ES.

8.5.3.29 Consideration will be given to inter-project cumulative effects, subject to availability of cumulative scheme information in the public domain.

Key Sensitivities

8.5.3.30 The following sensitive receptors most vulnerable to potential impacts from the Proposed Development have been identified:

- residents living in close proximity to the Proposed Development site;
- residents living in the wider communities, particularly in relation to the proposed haul routes.;

[136] East Riding of Yorkshire Council Strategic Housing Market Assessment 2019 (2019). Available at: www.eastriding.gov.uk [accessed on: 09/09/2022].

- 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); and
- community receptors (i.e. publicly accessible routes and PRoW used for recreation, and community land and assets).

8.5.3.31 As the community profile develops, the identification of sensitive community receptors will evolve. This will also be informed by feedback from stakeholders, collated from engagement and public consultation activities.

8.5.4 Likely Significant Effects to be Considered in the EIA

8.5.4.1 The design and location of the Proposed Development will seek to minimise potential impacts on human health resulting from the development.

Hydrogen Storage Facility

8.5.4.2 The key onshore elements of the Proposed Development from a health perspective will be the Hydrogen Storage Facility which is in the vicinity of the communities of Aldbrough, Flinton, Garton and Humbleton.

8.5.4.3 Communities have become used to the existing landscape and view of AGS, albeit at a distance for many, and any change to this viewscape may induce concern. The nature, layout and height of proposed facilities will need to be communicated and mitigation, where possible, discussed and agreed with local residents. Early works investment in tree planting and visual mitigation, is likely to be well received and the precedence exists for this.

8.5.4.4 Communities may be concerned about the impacts on the local road network and potential disruption to community life/amenities during the construction phase. The potential for inward migration of a workforce and where workers will park or potentially even stay, may also be raised. Local procurement of people, businesses and services will be a welcome part of the Proposed Development, mitigating such concerns but also enhancing socio-economic benefit to the area. Traffic management plans, use of haul routes and avoidance of known localised traffic 'hotspots' will all be considered as part of the communities and health assessment and mitigation planning.

Marine Infrastructure

8.5.4.5 It is not currently anticipated that there will be any significant effects on community receptors from offshore elements, with the possible exception of potential concern from communities around any nearshore construction activities that could be perceived to exacerbate coastal erosion and the knock-on impact this could have for communities and their feeling of safety and liveability. Potential concern may exist regarding marine assets or heritage.

8.5.4.6 These concerns are based on information gleaned from previous and ongoing community engagement as well as issues raised as part of objections related in 2006/7 to the planning application for the proposed AGS Extension (06/09372/STPLFE). Early engagement with both marine stakeholders and local stakeholders, as well as key statutory stakeholders such as Natural England, will be a core part of the Stakeholder Engagement Plan and should allow for a constructive dialogue to allay concerns and identify appropriate mitigation.

Traffic route

8.5.4.7 As noted in the traffic and transport section (see **Section 6.10**), a designated haulage route has been previously approved for construction and operational traffic access to the site of

the Hydrogen Storage Facility. The approved haulage 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 Hydrogen Storage Facility is located.

8.5.4.8 The haulage 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 haulage route does, however, pass directly through four settlements between the Hydrogen Storage Facility 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.

8.5.4.9 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 should be included in stakeholder engagement and consultation material. A detailed Traffic Management Plan will be developed and communicated with local stakeholders.

8.5.4.10 A summary of potential impacts is set out in Table 8.11 below. Potential effects on mental health and wellbeing, generated primarily through anxiety over the Proposed Development, are also listed in the table.

Table 8.11: Summary of potential effects to be assessed

Change in Physical Environment	Nature of Potential Effect
Increased noise levels generated through construction activity and affecting residents in closest proximity	Effect on quality of life and potential anxiety/distress. Temporary in duration with potential mitigation in the form of construction management planning and liaison with local stakeholders and community.
Impacts on air quality caused by increased traffic on the local road network, in particular during the construction phase	Effect on those living in closest proximity to the proposed traffic route, currently projected to be that stipulated in the Traffic Management Plan for AGS. Temporary in duration with potential mitigation in the form of construction management planning) and liaison with local stakeholders and community.
Visual impacts arising from construction activity and the presence of new operational facilities at the Hydrogen Storage Facility	Effect on residents living in closest proximity to the Hydrogen Storage Facility at Aldbrough. Effect on local leisure business on coastline from offshore activities. Temporary and/or permanent in duration.
Changes to Living Environment and Social Capital	**Nature of Potential Effect**
Anxiety over development in the area and uncertainty over the range of impacts/level of disruption which may be generated	Anxiety or distress, in particular, arising during pre-construction phase over concern of potential development. Temporary and/or permanent in duration with potential mitigation in the form of stakeholder engagement and preparatory communications.
Anxiety over the nature of operational facilities, in particular, the safety of hydrogen in terms of transportation and storage	Anxiety or distress caused by the nature of proposed technology. Temporary and/or permanent in nature with potential mitigation in the form of information provision and engagement.
Changes in access to community land and facilities, including recreational activities during the construction phase	Effect on access caused by construction activities. Temporary in duration with mitigation in the form of construction management planning and liaison with local stakeholders.

Changes in access for recreational use offshore during the construction phase	Effects on potential offshore/marine users during construction phase. Temporary in duration with mitigation in the form of liaison with marine stakeholders.
General disruption to community life and social capital caused by construction	Anxiety and disruption to community life and social capital caused, in particular, during construction phase. Temporary in duration with mitigation in the form of engagement and the Draft CEMP.
Economic Changes	**Nature of Potential Effect**
Changes in economic livelihood generated through direct and indirect employment	Direct and indirect employment, upskilling and inward investment giving rise to enhanced quality of life. Temporary and permanent in duration. Enhancement in the form of local procurement of goods, services and people.
Impact on local businesses through increased congestion on local road network during construction phase	Effect on those living in proximity to the proposed traffic route for the Proposed Development. It is anticipated that the Proposed Development would use the designated haulage route for AGS. Temporary in duration with potential mitigation in the form of construction management planning and liaison with local stakeholders and community.

8.5.4.11 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.

8.5.5 Effects Scoped out of the EIA

8.5.5.1 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.

8.5.5.2 Otherwise, as is consistent with best practice, no other potential effects on human health and wellbeing have been scoped out of the EIA. This is to ensure that full consideration is given to the range of potential effects as the Proposed Development develops and to allow the assessment to be informed by both wider technical assessments and feedback from stakeholders, which will be provided through ongoing engagement and public consultation.

8.5.6 Mitigation

8.5.6.1 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;

- 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 CTMP, which will address potential concerns around effects on the local road network and any concerns over potential secondary effects on local businesses and residents.

8.5.6.2 Mitigation will be identified and discussed with stakeholders, as appropriate, as the assessment evolves.

9. CUMULATIVE EFFECTS

9.1 Introduction

9.1.1.1 This chapter 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) as "*Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project*".

9.1.1.2 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.

9.2 Policy and Legislative Context

9.2.1.1 Schedule 4 paragraph 5 of the Infrastructure EIA Regulations 2017 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*".

9.2.1.2 The need to consider cumulative effects in planning and decision making is also set out in national planning policy. The NPPF 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*)."

9.2.1.3 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 EA and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards."*

9.2.1.4 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."*

9.2.1.5 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."*

9.2.1.6 The need to consider cumulative effects in planning and decision making is also set out in planning policy, in particular the NPSs with the Overarching NPS for Energy (EN-1) stating that *"When considering cumulative effects, the ES should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence)".*

9.3 Proposed Methodology Overview

9.3.1.1 The CEA process for the EIA will follow the approach set out in Advice Note 17, Cumulative Effects Assessment (August 2019). It sets out a four-stage approach to the assessment of cumulative effects:

- 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;
- Stage 3: information gathering as required; and
- Stage 4: assessment.

9.3.1.2 The proposed application of the methodology for each stage is described in the following sections.

9.4 Stage 1 (establishing a long list of 'other existing development and/or approved development')

9.4.1 General Considerations

9.4.1.1 Stage 1 of the CEA methodology involves establishing the Proposed Development's ZoI and identifying a long list of other developments for inclusion in the assessment.

9.4.1.2 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 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).

9.4.1.3 The Proposed Development will not have any substantive pollutant emissions to air. The search area will therefore be determined by the largest distance at which the Proposed Development could potentially have impacts, for example up to a defined radius around the Order Limits for landscape and visual impacts, which for the purpose of this Scoping Report is taken to be 5 km.

9.4.2 Scale of Other Developments

9.4.2.1 Table 9.1 sets out the proposed scale and spatial parameters to be used to identify the long list of other developments for the CEA.

Table 9.1: Planning Categories Scale and Spatial Scopes

Category (Note 1)	Spatial scope
Nationally Significant Infrastructure Project: terrestrial project applications	5 km from the onshore components of the Proposed Development
Nationally Significant Infrastructure Project: marine project applications	Up to two tidal excursions from the marine works components of the Proposed Development

Category (Note 1)	Spatial scope
Section 36 (including variations) and 37 of the Electricity Act applications	5 km from the onshore components of the Proposed Development
Transport Works Act Application: terrestrial project applications	5 km from the onshore components of the Proposed Development
Transport Works Act Application: marine project applications	Up to two tidal excursions from the marine works components of the Proposed Development
Town and Country Planning Act 1990 (TCPA): 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.	5 km from the onshore components of the Proposed Development
Marine and Coastal Access Act 2009: consented developments that required an EIA under the respective 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, and other applications and consented development included at the discretion of the MMO.	Up to two tidal excursions from the marine works components of the Proposed Development

9.4.2.2 Regarding development falling under the Town and Country Planning Act 1990 or the Marine and Coastal Access Act 2009, 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).

9.5 Stage 2 (establishing a shortlist of 'other existing development and/or approved development')

9.5.1 Temporal Considerations

9.5.1.1 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.

9.5.1.2 Where a construction period likely to overlap with the timeframe from 2024 and the asset be operational from 2032 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.

9.5.1.3 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.

9.5.2 Technical Considerations

9.5.2.1 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.

9.5.2.2 The topics, impacts and zones of influence detailed in Table 9.2 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.

9.5.2.3 As the proposed zones of influence are defined by individual topics they vary.

Table 9.2: Proposed Development Impacts (and their ZoI) with Potential to Contribute to Cumulative Effects

Topic	Potential Impacts	Zone of Influence
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 chapter.	Up to 350 m from the Proposed Development site boundary. N/A
Air quality: operation	All major equipment will be electrically driven and therefore there will be no substantive emissions to atmosphere.	N/A
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 has an indirect global warming potential (GWP) through its impact on atmospheric chemistry.	N/A
Noise: terrestrial 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: terrestrial 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 particular activities such as driven piling or use of vibratory compactors.	Up to 100 m from the Proposed Development site boundary for the onshore elements.

Topic	Potential Impacts	Zone of Influence
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: terrestrial construction	Construction aqueous wastes will be managed within the site and any effluent discharges will be required to meet the requirements of the EA in accordance with The Water Environment (WFD) (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: terrestrial operation	Surface water will be managed within the site and any effluent discharges will be required to meet the requirements of the EA in accordance with The Water Environment (WFD) (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 FRA will consider other development likely to occur within the wider area and so will inherently consider cumulative flood risk.	N/A
Terrestrial 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.
Terrestrial 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 but for the Hydrogen Storage Facility only.

Topic	Potential Impacts	Zone of Influence
Marine ecology and nature conservation: general construction	During construction, potential cumulative disturbance effects, mobilisation of suspended solids etc could occur with other developments being constructed in close proximity.	Two tidal excursions from the marine works area.
Marine ecology and nature conservation: noise	During construction piling will be the largest source of noise.	To be determined by noise modelling and agreed with consultees (noting this activity will be of very brief duration limiting its scope to coincide with other noisy activity).
Marine ecology and nature conservation: leaching operation	During leaching of the salt caverns there will be a brine discharge to sea. Other discharges to sea in the vicinity could have cumulative effects with the Proposed Development.	Two tidal excursions from the diffuser location.
Landscape (and seascape) 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 seascape) 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 site boundary (Hydrogen Storage Facility only).
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
Commercial fisheries and marine	The Proposed development will require multiple vessel movements associated with various construction	To be agreed in consultation

Topic	Potential Impacts	Zone of Influence
navigation: construction	activities, which could have cumulative effects on commercial fishing activity and other sea users.	
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 HIA 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

9.5.2.4 The possible cumulative effects of major accidents and disasters will be integrally considered under that topic. Such potential effects are effectively controlled through other legislation enforced by 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 or vice versa.

9.5.2.5 The other developments identified and shortlisted at Stages 1 and 2 of the CEA will be presented in the PEIR (and ES), with details of their current status. Other developments will be progressively screened out or in from the long list based firstly 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.

9.6 CEA Stages 3 and 4

9.6.1.1 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 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).

9.6.1.2 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.

10. SUMMARY AND NEXT STEPS

10.1 Overview

10.1.1.1 The information included in the Scoping Report is provided to support the Applicant's request for a Scoping Opinion from the SoS in relation to the development of the Proposed Development.

10.1.1.2 The Scoping Report is intended to support engagement with the Planning Inspectorate 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 offshore and terrestrial 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 application for Development Consent.

10.2 Summary of Scoped Out Impacts

10.2.1.1 **Chapters 6 to 8** of this Scoping Report identify all the topics that are proposed and will be assessed during the EIA process. Table 10.1 identifies those topics and sub-topics that have been scoped out of further assessment. Justification for these are provided in **Chapters 6 to 8**.

Table 10.1: Topics scoped out of further assessment

Topic	Proposed scope of assessment	Aspects to be scoped out
Terrestrial		
Geology and Ground Conditions	Contamination during intrusive construction. Dewatering of trenches and excavations during construction. Physical intrusion into groundwater resource during construction.	The sterilisation of future mineral resources during the construction and operational phases as the Proposed Development is not located within or near to minerals safeguarding areas. Damage to designated geological SSSI during the construction and operational phases as the Proposed Development is not located within or near to designated geological SSSI. Exposure of the workforce to health impacts as any pathways between receptor and source will be avoided through use of PPE. Soil compaction and changes to current drainage and water infiltration to ground during construction as standard industry practices for the protection of top and subsoils will avoid compaction impacts. Potential contamination of the ground and groundwater from accidental leaks and spillages as standard construction and drilling industry practices will be adopted to mitigate potential impacts.
Water Resources and Flood Risk	Potential Impact of the Proposed Development on water resources and potential changes to flood risk during construction and operation.	Impacts on water quality from chemical pollution, erosion and sedimentation on designated sites as the Proposed Development is adjacent to a 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.
Air Quality	Construction of the Proposed Development	At this stage it is assumed that the only relevant Air Quality emissions to the atmosphere associated with the operation of the Proposed Development will be from emergency flaring and flaring during maintenance, and this only if the flaring option is preferred over venting. Therefore operation of the Hydrogen Storage Facility is scoped out of further assessment except for emergency flaring and flaring during maintenance.
Noise and Vibration	Construction and decommissioning of the Proposed Development including the CPA, drilling of	As no significant vibration generating equipment will be required during operation of the Proposed Development, operational vibration assessment has been scoped out. Operational road traffic as significant increases in road traffic noise are not anticipated.

Topic	Proposed scope of assessment	Aspects to be scoped out
	caverns, offshore construction works near shore and construction traffic. Operation of the CPA, wellhead and leaching area and the hydrogen vent / flare.	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.
Ecology and Nature Conservation	Potential effects of construction and operation of the Proposed Development on designated sites, bats, badgers, birds, GCN and water vole	Background data searches have indicated that dormice are considered absent from the county of East Riding of Yorkshire. Thus, potential effects on dormice have been scoped out. Construction and operation of the Proposed Development on white-clawed crayfish as ditches at the Hydrogen Storage Facility are unsuitable habitat.
Landscape and Visual Assessment	Construction of the Proposed Development including the Hydrogen Storage Facility, wet well and sub-surface infrastructure. Operation and decommissioning of the Hydrogen Storage Facility	Construction and operation of the Proposed Development on the following landscape and visual receptors: ■ LCTs / LCAs located beyond 2.5 km radius around the Hydrogen Storage Facility; ■ LCTs / LCAs within 2.5 km radius around the Hydrogen Storage Facility boundary and 1km offset from the construction works boundary, but which do not fall within the ZTV output; and ■ Visual effects on visual receptors beyond 2.5 km of Hydrogen Storage Facility boundary or those locations judged to have limited or no visibility of the Proposed Development following the results of the ZTV and verification on site.
Historic Environment	Ground disturbance during construction phase causing potential loss of whole or part of a buried archaeological site. Impacts during construction, operation and decommissioning phases on the setting of cultural heritage sites and landscapes	Some parts of the Hydrogen Storage Facility have been subjected to comprehensive archaeological investigation as part of previous planning applications. This includes the southern area proposed for the CPA where the ground has already been stripped and topsoil and subsoil removed under archaeological supervision. This area is therefore scoped out of further assessment.

Topic	Proposed scope of assessment	Aspects to be scoped out
Traffic and Transport	Potential effects on traffic and Transport from construction and operation traffic of the Proposed Development	Construction and operation of the Proposed Development considered as part of other assessments in the Scoping Report (Air Quality and Noise). Transporting hazardous loads during the construction phase 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 It is not possible to accurately forecast baseline traffic flow levels 30 years into the future. For this reason, further work would be undertaken at the time of decommissioning to determine if significant transport effects might be experienced.
Marine Infrastructure		
Physical Environment and Water Quality	Construction and operation of the Proposed Development	Changes in the sediment transport regime during both construction and operation of the Proposed Development as these will be small and localised. Coastal morphology through changes to waves regimes as the Proposed Development is too small to have an impact on this.
Benthic and Intertidal Ecology	Construction and operation of the Proposed Development	Direct and indirect seabed disturbances leading to the release of sediment contaminants as there is no evidence of sediment contamination in the area from previous surveys and there are no nearby industrial discharges to it. Accidental pollution events during construction and operation as these will be limited to possible fuel oil release in the event of a vessel grounding or vessel-to-vessel collision and will be managed through implementing measures contained in an ERP.
Fish and Shellfish Ecology	Noise disturbance to fish, and temporary localised increases in SSC and smothering during construction.	Direct damage and disturbance to mobile demersal fish and shellfish species during construction as the impacts will be of local extent, short term duration and reversible. Accidental pollution events during construction and operation as these will be limited to possible fuel oil release in the event of a vessel grounding or vessel-to-vessel collision and will be managed through implementing measures contained in an ERP.

Topic	Proposed scope of assessment	Aspects to be scoped out
	Impacts on water quality from the discharge of brine and fishing pressure during operation	Disturbance from operation and maintenance activities as these will have a local extent and will be intermittent of short duration
Marine Mammals	Construction of the Proposed Development	Non-piling construction noise as it will only affect marine mammal receptors in the immediate proximity. Operational noise from pumping of seawater and/or brine through the pipeline is expected to be low. Operational disturbance and collision risk from vessels as a vessel management plan will be developed which will determine vessel routing to and from operational areas and ports to avoid areas of high risk. Reduction in prey availability as no significant effect is expected on prey, fish populations or habitats. Reduction in foraging ability due to suspended sediment as its not expected that there will be a significant increase in suspended sediment as a result of construction, operation or decommissioning.
Marine Archaeology	Construction and operation of the Proposed Development	No aspects have been scoped out of further assessment.
Commercial Fisheries	Construction of the Proposed Development	Operation of the Proposed Development as it will not lead to a reduction in access to, or exclusion from, established fishing grounds nor displacement or disruption of commercially important fish and shellfish resources.
Seascape and Visual Resources	Construction activities visible day and night from beach and offshore	Construction activities visible day and night from onshore as the location of the activity will ensure it is not visible to onshore receptors. Operation of the Proposed Development since the only feature above sea or beach level will be the existing monopile.
Infrastructure and Other Users	There is no other infrastructure, or use of the area by other sea users, that could be affected by the Proposed Development and is therefore proposed to scoped out of further assessment.	
Shipping and Navigation	Increased collision risk – movement and presence of vessels increasing the risk of collision with third party vessels	Vessel to vessel collision risk as the scale of the Proposed Development is relatively small and construction and decommissioning phases are expected to be short term. Anchor snagging as mitigation would reduce the likelihood of snagging during operation.

Topic	Proposed scope of assessment	Aspects to be scoped out
	during the construction and decommissioning	Restricted emergency response capability as the scale of the Proposed Development is relatively small and construction and decommissioning phases are expected to be short term.
All Project Elements		
Socio-economic Aspects	Construction and operation of the Proposed Development	Flaring of hydrogen as the rural nature of the receiving environment, the limited number of potential receptors and the use of flaring will be intermittent.
Waste Management	Construction and operation of the Proposed Development	Decommissioning phase of the Purposed Development as it is unlikely to generate large volumes of inert material and the majority of surface equipment will be dealt with in accordance with the waste hierarchy.
Major Accidents and Hazards	Construction and operation of the Proposed Development	No aspects have been scoped out of further assessment.
Human Health	Construction and operation of the Proposed Development	Flaring of hydrogen as the rural nature of the receiving environment, the limited number of potential receptors and the use of flaring will be intermittent.

10.2.1.2 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 surveys (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.

10.2.1.3 On the basis of the above considerations **Chapters 6 to 8** set out the technical scope for the EIA, and in some instances propose matters to be scoped out of the EIA. The chapters 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.

10.2.1.4 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.

10.2.1.5 The findings of the EIA, based on the application of the methodologies set out in **Chapter 5**, and topic-specific approaches in **Chapters 6 to 8**, will be reported in the ES to be submitted as part of the planning application.

10.3 Consultation

10.3.1.1 Before an application for a DCO is submitted to the Planning Inspectorate, extensive consultation with key stakeholders (local authorities, statutory bodies, the local community and interest groups) is required. The Applicant will undertake this consultation according to a series of phases. The Applicant has produced this Scoping Report as part of its initial phase of consultation. A Scoping Opinion, coordinated by Planning Inspectorate, will result in feedback will be fed into the ongoing EIA process for the Proposed Development.

10.3.1.2 This will then be followed by further (non-statutory) public consultation in 2023, that will share with key stakeholders and the local community how the feedback received in the scoping period has been incorporated into the proposal.

10.4 Next Steps

10.4.1.1 Once the Scoping Opinion has been obtained from the Planning Inspectorate, preparations will be made for both the formal pre-application consultation stage under Sections 42, 47 and 48 of the Planning Act 2008. The EIA and Proposed Development design will proceed with envelope refinement, further assessment and analysis. A PEIR will be produced and consulted on in 2024. The PEIR will provide an initial statement of the environmental information available for the Proposed Development study area, including descriptions of the likely environmental effects and mitigation measures adopted as part of the Proposed Development. The PEIR is intended to allow those taking part in the consultation to understand the nature, scale, location and likely significant environmental effects of the Proposed Development, such that they can make an informed contribution to the process of pre-application consultation under the Planning Act 2008 and to the EIA process.

10.4.1.2 The project website https://www.aldbroughhydrogen.com/ will be maintained to provide information and updates on the Proposed Development, and matters relating to the proposed application. The mandatory requirements for the content of an ES are set out in Regulation 14 (2) supplemented by Schedule 4 of the 2017 EIA Regulations. Regulation 14 (3) (a) requires that an ES *"be based on the most recent scoping opinion adopted"*; the PEIR will set out clearly how the matters raised in the scoping opinion have been addressed. Regulation 14 (3) (b) requires that the ES *"include the information reasonably required for reaching a reasoned conclusion on the significant effects of the development on the environment, taking into account current knowledge and methods of assessment"*. The PEIR will include such information and set out the methods of assessment. Regulation 14 (3) (c) requires that the ES *"be prepared, taking into account the results of any relevant UK environmental assessment, which is reasonably available to the applicant with a view to avoiding duplication of assessment."* A cornerstone of the proportionate approach to the PEIR and ES is to take into account the accepted results of other environmental assessments as part of the evidence base. Regulation 14 (4) refers to the competence of those involved in undertaking the EIA. The PEIR will set out in brief in its Introduction the persons and organisations involved and their relevant qualifications.

10.4.1.3 The Applicant plans to further refine the Proposed Development based upon the consultation responses received from the PEI process. The final results of the EIA will be presented in an ES and a summary of all consultation responses received will be presented in a Consultation Report, both of which will accompany the DCO application.

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